June 1979 $2.50

73 Magazine for Radio Amateurs

28 **Add Digital Display for $50**
—100-Hz accuracy. K4IQJ

32 **High-Performance Receiver Add-Ons**
—aren't ICs wonderful?. W5DA

38 **A Solution to the Home-Brew Housing Shortage**
—building a box for your next project. W0IHI

42 **How Do You Use ICs?**
—part XI. WA2SUT/NNN0ZVB

46 **Customize Your HT144B**
—some nifty mods. W2KGV

50 **Ultra-Simple CMOS Logic Probe**
—a single IC does it all. WB9PHM

54 **"The Voice of Wolf Creek"**
—the KGCX story. W6CK

60 **CB to 10**
—part XIX: Lafayette SSB rigs. WB0LLP/5

64 **At Last! A Really Simple Speech Processor**
—5 dB for $10. . . . . W9UT, WB9OEC

66 **New Life for Tube-Type Dippers**
—simple circuit reads out on your frequency counter. K4LJA

68 **You Ought To Be in Pictures**
—here's what the guys on 14,230 are doing. K4TWJ

72 **How to Toot Your Own Horn**
—and stay on key. WA4CLG

76 **A Junk-Box HT Charger**
—power to the portables. WB9JLY

80 **Protect Your Home-Brew Panels**
—no more spraying. VE2BVW

86 **Now You Can Possess Instant Recall**
—don't tell 'em the computer helped. WB5UTJ/N5AUX

92 **Calcu-Trip**
—a program for the open road. . . . . Lutz

94 **Charging Up the WE-800**
—a convenient alternative. K7CMS

96 **Where Have All the kHz Gone?**
—are ham bands an endangered species?. W8GI

100 **The Ramsey 2m Amp Kit**
—has a high Watts-per-dollar ratio. N8RK

108 **An Improved Display for the TR-7400A**
—very sensible. WA6AVJ

110 **Inexpensive Scope Tuner**
—"budget here is QRP, OM". VE7CGK

112 **The Resistance Substitution Box**
—a ham's forgotten friend
. . . . . WA2SUT/NNN0ZVB

126 **Vodka Amongst the Penguins**
—hamming with the Russians in Antarctica. W1FK

138 **Protect Yourself with a GFI**
—before it's too late. WA6PEC

142 **Poor Man's CW Memory**
—works even with a straight key. WB0RYN

146 **Power Up for Mobile Operation**
—adding an auxiliary battery. WB9SKX

148 **Project Update**
—doubled capacity for K2OAW's repeater IDer. K2OAW

Never Say Die—4, Looking West—6, Letters—12, Microcomputer Interfacing—14, Contests—18, Faces, Places—19, RTTY Loop—20, DX—22, New Products—24, Ham Help—25, 26, 156, 157, 163, Social Events—26, Dealer Directory—70, OSCAR Orbits—157, Corrections—157, FCC—163, Propagation—193

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Before you invest your hard earned money in a linear amplifier, consider what's inside. That's where the difference in quality is obvious. No lightweight, cheaply built components...In Henry amplifiers you will find only the best quality, heavy duty components. We build our amplifiers to perform at peak level month after month, year after year. Both the 2KD-5 and the 2K-4A will operate full legal power continuous duty on all modes. We offer the amateur the linear amplifier that we would want in our own stations.

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- Two Eimac 3-500Z glass envelope triodes operating in a grounded grid circuit.
- Pi-L plate circuit with a rotary silver plated tank coil for greatest efficiency and maximum attenuation of unwanted harmonics.
- Full legal input in all modes. 2000 watts PEP input for SSB. 1000 watts DC input for CW, RTTY and AM.
- Jumper for 115 or 230 VAC, 3 wire single phase.
- 10.5" high x 15" wide x17.5" deep
- Price . . . $945.00

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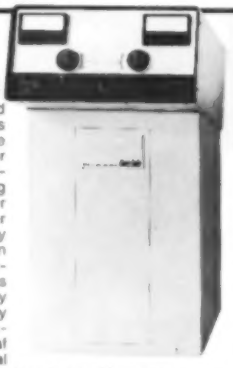
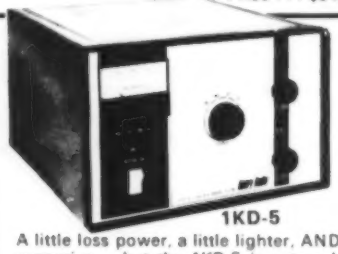


Never has a linear amplifier racked up so many hours of dependable operation for amateurs worldwide ... operating at full legal power ... hour after hour ... under every type of condition imaginable. Because the 2K-4A is built with the very best, heavy duty components available, it can loaf along at full legal power. It offers engineering and features second to no other linear on the market. The 2K-4A will put your signal on the air with greater strength and clarity than you ever dreamed possible. Operates on all amateur bands, 80 thru 15 meters (export models include 10 meters)•Two rugged Eimac 3-500Z grounded grid triodes•Pi-L plate circuit with silver plated tank coil•Resonant cathode-pi input circuit•Built-in SWR bridge & relative RF output meter•Maximum legal input all modes. Price $1195

The 2K-4 is still available for export and military use.



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A little less power, a little lighter, AND less expensive . . . but the 1KD-5 is a true Henry Radio linear amplifier, offering superior quality and dependability. It is designed to greatly boost the strength and clarity of your signal. Its heavy duty components guarantee years of trouble free, dependable performance.

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A high quality linear amplifier designed for commercial and military uses. The 3K-A employs two rugged Eimac 3-500Z grounded grid triodes for superior linearity and provides a conservative three kilowatts PEP input on SSB with efficiencies in the range of 60%. This results in PEP output in excess of 2000 watts. It provides a heavy duty power supply capable of furnishing 2000 watts of continuous duty input for either RTTY or CW with 1200 watts output. 3.5-30 MHz. Price $1595.

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Specifically designed for the most demanding commercial and military operation for SSB, CW, FSK or AM. Features general coverage operation from 3.0 to 30 MHz. Using the magnificent new Eimac 8877 grounded grid triodes, vacuum tune and load condensers, and a vacuum antenna relay, the 4K-ULTRA represents the last word in rugged, reliable, linear high power RF amplification. 100 watts drive delivers 4000 watts PEP input.

Price $3450.

*Not available for sale to amateurs in the U.S.

Export inquiries are invited.

Export models of Amateur units available for 10 meter operation also.

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Henry Radio

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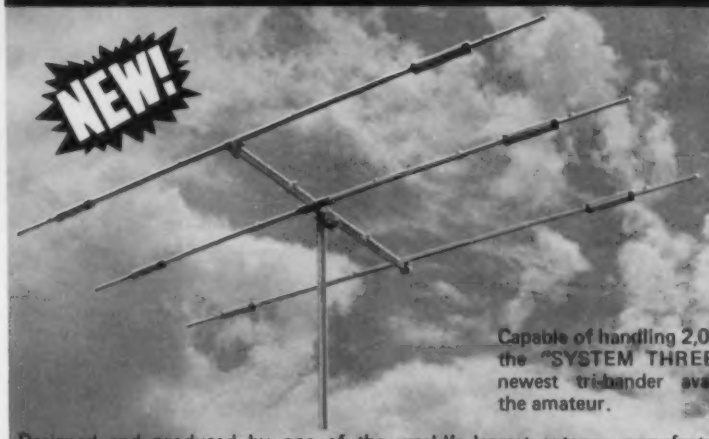
THE SYSTEM THREE TRIBANDER ANTENNA . . .

Top Performance for 20 - 15 - 10 Meters!



Capable of handling 2,000 watts, the "SYSTEM THREE" is the newest tri-bander available to the amateur.

Wilson

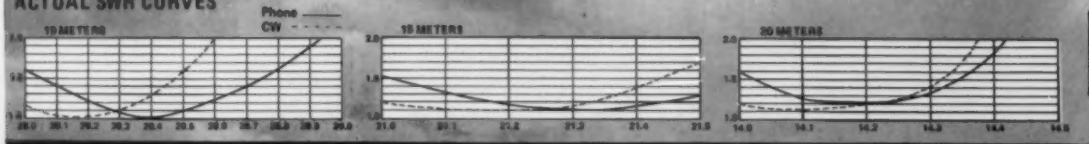
SY-3

SPECIFICATIONS

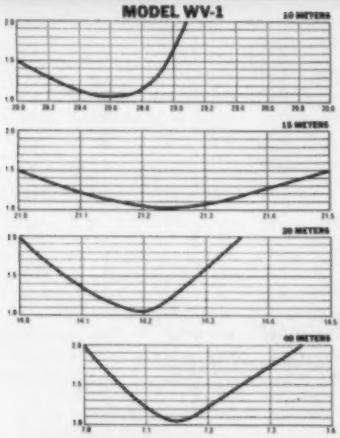
Band MHz	14-21-28
Maximum power input	Legal limit
Gain (dBd)	8 dB
VSWR at resonance	1.3:1
Impedance	50 ohms
F/B ratio	20 dB
Boom (O.D. x length)	2" x 14' 4"
No. of elements	3
Longest element	27' 4"
Turning radius	15' 9"
Maximum mast diameter	2" O.D.
Surface area	5.7 sq. ft.
Wind loading at 80 mph	114 lbs.
Assembled weight (approx.)	37 lbs.
Shipping weight (approx.)	42 lbs.
Direct 52 ohm feed or balun	
Maximum wind survival	100 mph

Designed and produced by one of the world's largest antenna manufacturers, the traditional quality of workmanship and materials continues on with the "SYSTEM THREE". The special heavy-duty vise-like extruded aluminum clamps on the reflector and director are a key point in the design of strength and durability. Superior clamping power is obtained with the use of a rugged ¼" thick aluminum plate for boom to mast mounting. The use of large diameter High-Q Traps in the "SYSTEM THREE" makes it a high performing tri-bander with a very economical price. A complete step-by-step illustrated instruction manual guides you to easy assembly and the lightweight antenna makes installation of the "SYSTEM THREE" quick and simple.

ACTUAL SWR CURVES



40 THRU 10 METERS VERTICAL TRAP



WV-1 WILSON VERTICAL TRAP ANTENNA

No bandswitching necessary with this vertical. An excellent low cost DX antenna with an electrical quarter wavelength on each band and low angle radiation. Advanced design provides low SWR and exceptionally flat response across full width of each band. Featured is the Wilson large diameter High-Q traps which will maintain resonant points with varying temperatures and humidity. Easily assembled, the WV-1 is supplied with base mount bracket to attach to vent pipe or to mast driven in the ground. The new WV-1 Antenna is value priced . . . and ships via UPS!

SPECIFICATIONS

Input Impedance: 50 ohms • Powerhandling capability: Legal Limit • Two High-Q Traps with large diameter coils • Low Angle Radiation Omnidirectional performance • Taper Swaged Aluminum Tubing • Automatic Bandswitching • Mast Bracket furnished • SWR: 1.1:1 on all Bands • 1½" O.D. heavy wall aluminum tubing • Does not require guying • Overall length: 19' 8".

W2

Consumer Products Division

Wilson Electronics Corp.

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Prices and specifications subject to change without notice.

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W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

GETTING THE CROWDS

Dayton knows how to get 'em out by the thousands, but many other hamfests are floundering. Prizes are nice, but how many hams will drive 200 miles to take a slight chance at winning a rig? Not many. If Dayton depended on the prizes to bring in the customers, the mobs would stay home.

The more established hamfests have to keep growing to survive. We've watched the bungling of SAROC into obscurity. It grew smaller and smaller every year, despite lavish prizes. Other hamfests have been withering for the lack of any hot spark to make them grow.

There was a time in history when the ARRL had but to make a hamfest official and this would bring in the hams. Now few hams will drive across town to get to an ARRL forum, much less drive 200 miles. Those who have attended these dreary forums know what I'm talking about. They have been so orchestrated that it is impossible for anything significant to happen. Pompous officials get up and tell everyone how great the League is and how everything is really okay, no matter what anyone else says. End of meeting.

ST. LOUIS

The recent hamfest in St. Louis set an example of what can be done by a live-wire group. Bob Heil K9EID called me up along in December and asked what he would have to do to get me to come out to St. Louis and give a talk to his club in Marissa, Illinois. I said it was simple—just put on a major hamfest and invite me. The next thing I knew he was doing just that.

Bob got all except one club in the area together to sponsor the hamfest, threw in a computerfest to boot, complete with some computer clubs, and ran a bang-up show. Bob contacted the League, but they said he couldn't put on a hamfest without their support, and they had a long list of demands he had to meet to get their support. He decided to go it without them. The result was a superlative success. Over 3,000 hams thronged to the St. Louis Cervantes Exhibition Center, despite lousy weather.

What pulled in such a big crowd? It wasn't any ads in *QST*, for there wasn't a hint about the show there. It was mentioned a lot in *73* . . . about the only place for many hams to get the word. But just reading about a hamfest and actually going are two different things. Something happened to break all those people loose and get them to drive to St. Louis. Despite a competing hamfest in Kansas, a large number of Kansas hams went right by there on their way to the St. Louis show.

I think the difference between the shows is simple to explain. People will go to a show where they think they are going to have a good time. In this case, there was a controversial speaker—me—on tap to talk about things which really can't be published in the magazine. If hamfest committees would spend more time and effort getting speakers who will make hams want to come to the hamfests, they will have plenty of attendance.

The ARRL convention in St. Paul had both me and Harry Dannals on the program. The committee running the convention told me that they doubled the attendance by having me on the program. Sure, I like to hear that . . . but what this means is that the speaker is of great importance . . . greater than many

Signing a proclamation for Amateur Radio Day in St. Louis is Mayor Conway. From left to right are Larry Roberts W9MXC, Bob Heil K9EID, Mayor Conway, and beaming me.

Continued on page 160

73 Magazine (ISSN 0098-9010) is published monthly by 73, Inc., Pine Street, Peterborough NH 03458. Subscription rates in the U.S. and Canada are $18 for one year, and $45 for three years. Outside the U.S. and Canada, write for rates. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Publication No. 700420. Phone: 603-924-3873. Microfilm edition—University Microfilm, Ann Arbor MI 48106. Entire contents copyright 1979 by 73, Inc. INCLUDE OLD ADDRESS AND ZIP CODE WITH ADDRESS CHANGE NOTIFICATION and send to 73, Inc., Subscription Services Dept., P.O. Box 931, Farmingdale NY 11737.

TR-7600 TR-7625

RM-76

TS-700SP

Compact in size... big on performance!

TR-7625
Features 25 watts RF output (switchable to 5 watts low power), the TR-7625 is a high-performance 2-meter FM transceiver with memory, and is designed to permit multi-channel (800-channel) operation. Compact and perfect for mobile or ham shack use. When used with optional RM-76 Microprocessor Control Unit, the TR-7625 offers a whole new dimension in channel memory and scanning capability.

TR-7600
Looks the same as the TR-7625, but offers 10 watts RF output (switchable to 1 watt low power). Also uses RM-76 Microprocessor Control Unit. For the Amateur Operator who's looking for optimum versatility in a 2-meter FM transceiver!

RM-76
Combined with either the TR-7600 or TR-7625, this optional Microprocessor Control Unit allows the operator to store frequencies in six memories (simplex/repeater); scan all memory channels; automatically scan up the band in 5-kHz steps; manually scan up or down in 5-kHz single or fast continuous steps; set lower and upper scan limits; clear scan (for transmitting); stop scan (with HOLD button); scan for busy or open channel; select repeater mode (simplex, transmit frequency offset (±600 kHz or ±1 MHz), or one memory transmit frequency. Operates on 143.95 MHz simplex (MARS) and is adaptable to all MARS frequencies. Display indicates frequency (even while scanning) and functions (such as autoscan, lower scan frequency limit, upper scan limit, and error, i.e., transmitting out of band).

TS-700SP
Here's an outstanding 2-meter all-mode transceiver that provides an extra dimension of versatility over the entire 2-meter band. Feature packed and equipped for SSB, FM, CW and AM. Complete with built-in digital frequency readout, receiver preamplifier, VOX, sidetone, and microphone.

SPECIFICATIONS	Models TR-7600/TR-7625	Model TS-700SP	Model TR-4300
Frequency Range:	144.00 to 147.995 MHz	144.0 to 148.0 MHz	TX: 445.0 to 450.0 MHz RX: 442.0 to 447.0 MHz
Mode:	FM	SSB (USB, LSB), CW, AM, FM	FM
Dimensions:	161mm (6-5/16") wide 51mm (2-3/8") high 230mm (9-1/16") deep	270mm (10-7/8") wide 124mm (4-7/8") high 320mm (12-5/8") deep	180mm (7-1/16") wide 60mm (2-3/8") high 240mm (9-7/16") deep
Weight:	1.75kg (3.85 lbs) Approx.	11.0kg (24.2 lbs)	2.3kg (5.1 lbs)
RF Output Power:	High: 10(●25) watts (min.) Low: 1(●5) watt approx. (adjustable to 10 watts)	SSB, FM, CW—10 watts AM—3 watts FM (Low)—Approx. 1 watt	High: 10 watts Low: 1 watt Approx.
Modulation:	Variable reactance direct shift	SSB: Balanced modulation FM: Variable reactance frequency shift AM: Low-power modulation	Variable reactance phase shift
Microphone:	Dynamic microphone with PTT switch, 500 Ω	Low-impedance microphone (500 Ω)	Low-impedance microphone (500 Ω) with PTT switch
Sensitivity:	Less than 0.4 μV for 20 dB quieting	Less than 0.4 μV for 20 dB quieting SSB & CW: 0.25 μV for 10 dB (S+N)/N AM: 1.0 μV for 10 dB (S+N)/N	1 μV for 30 dB (S+N)/N 0.5 μV for 20 dB noise quieting
Squelch Sensitivity:	Less than 0.25 μV	0.25 μV	0.3 μV
Selectivity:	More than 75 dB at 30 kHz of adjacent channel	SSB, CW & AM: 2.4 kHz/-6 dB, 4.8 kHz/-60 dB FM: 12 kHz/-6 dB, 24 kHz/-60 dB	20 kHz/-6 dB 40 kHz/-70 dB
Image Rejection:	More than 70 dB	Better than 70 dB	

ACCESSORIES – VFO-700 remote VFO, SP-70 external speaker, KPS-7 power supply; MC-50 base microphone, MC-30S mobile noise-canceling microphone, and MC-45 Touch-Tone microphone.

See your Authorized Kenwood Dealer for more details.

TR-8300
Designed for use in the 70-cm amateur band. Unique design of the TR-8300 makes it a great choice for mobile or fixed-station use. This FM transceiver is capable of F3 emission on 23 crystal-controlled channels (three supplied). Transmitter output is 10 watts.

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Looking West

Bill Pasternak WA6ITF
24854-C Newhall Ave.
Newhall CA 91321

Attention, nostalgia buffs—have we got something for you! As many of you are aware, K6MYK (now WR6ABN) was one of the nation's first successful amateur repeaters. It has been in almost constant day-to-day operation since the spring of 1956. Anyway, in doing research for a new FM and repeater book, I spent a bit of time with MYK's designer/builder/licensee Art Gentry W6MEP. During the course of one afternoon visit, Art hauled out a true piece of amateur relay history.

In the accompanying photo, Art is busy dusting the cobwebs off the original K6MYK receiver. The receiver was designed and built by Art in the early 1950s and was the first such device specifically designed for mountaintop relay service. It is a single conversion affair with a cavity front end with an overall bandwidth on the order of 40 to 50 kHz. Not exactly narrowband, but in those days it was years ahead of its time. This was an AM receiver, since K6MYK was originally an AM repeater.

This receiver remained in service until about 1969, when it became obvious that FM was going to replace AM as the "in" on two meters. During its lifetime, it performed admirably. Only an occasional tube had to be replaced. This receiver was part of an overall repeater package whose survival and growth pattern helped pave the way for much of what we have today.

AS-RADIO-SHACK-GOES-SO-GOES-THE-???? DEPARTMENT

Of the many magazines, pamphlets, and flyers that come across my desk each month, perhaps my favorite is the monthly flyer published by Radio Shack. No, it's not because of the monthly specials RS runs. No . . . the first thing I do is look for something called the "Flyer Side Chat," written by Radio Shack President Louis Kornfeld.

I've never met the man, but after reading about 35 or so of his columns, I kind of feel that I know him. Through him, I may have gained a bit of insight into the RS operation itself. Tandy/RS is really a company on the grow, and Louis Kornfeld is obviously quite proud of that fact. It's not what he writes, but rather the obvious positive approach with which he writes that makes his pride obvious even to the occasional reader. He is also a very straightforward man who likes to speak his mind; his "Flyer" editorials never beat around the bush.

I mention all this because I have found Radio Shack to be a good indicator of the state of the entire hobby electronics industry. They are trend-setters, unafraid to take a giant step forward if a viable market seems available. Witness the success of their TRS-80 computer and many other RS products too numerous to mention. The nice thing about Louis Kornfeld's "Flyer Side Chat" is that it gives you ongoing insight. To see what I mean, I suggest that you visit your local RS and pick up their current "Flyer." If you are like me, you will probably get hooked on Kornfeld's editorial comment . . . or on a TRS-80 of the kind I am saving my pennies for these days.

THE 220-UP-NORTH DEPARTMENT

Ward Hill WA6FUH is an old friend of mine. I first met Ward in 1972, about a month after moving to the southland. In fact, one of the very first Looking West columns announced his engagement. Since then, Ward and his wife Barbara have relocated in Camino, California, where Ward operates his own dental laboratory. I had not heard from Ward for a long time, until the other day when our "postal lady" delivered a rather interesting note from him that I wish to share with you. It concerns a 220 repeater project that Ward and some other local amateurs are involved in.

It all started about a year ago on 146.52. Ward's house sits at about the 3000' level, and, needless to say, he does not need very much power for good simplex coverage. One day on .52, Ward talked with a group of amateurs in Sacramento who were looking for a location for a 220 repeater. One thing led to another, and when WB6UBF/RPT commenced operation, it did so from Ward's house (where it still resides today). As you may have surmised, UBF has rather good coverage. It is an open machine operating on 223.10 MHz in and 224.70 MHz out, with a 90-degree antenna pattern which gives excellent coverage throughout the Sacramento, Stockton, and Auburn, California areas. It also gives some extended coverage to places as far away as San Jose. Not bad for a home-built system that started life as a Clegg FM-76 transceiver.

By the way, an interesting method was utilized by this group to obtain the desired coverage and pattern direction. Rather than use a J-pole antenna phased for a cardioid pattern, the UBF antenna system consists of four 7-element KLM yagis fed from a four-port KLM power divider (which in turn is connected to a Phelps-Dodge 220-MHz duplexer). They are fanned out at equal intervals to produce the desired pattern. Ward reports that results with this novel approach have been far better than expected.

Currently, UBF has about 15 regular user/supporters, but it also has the welcome mat out for anyone else who wishes to drop by the channel pair. There are plans in the mill for a two-meter remote downlink to selected simplex and repeater channels, along with a second downlink to six meters for operating DX openings and six-meter path experimentation. Other projects on the fire include a complete touchtone decoder system to activate most of the foregoing, along with a secondary power source which might be solar. Of course, all of those plans are dependent upon usership growth and financial support.

Each week, we hear of new 220 relay activity starting up here or there. This is extremely important news, in that it helps ensure the future of that spectrum. It's no secret that our own government is about to try to sell out 220 MHz at WARC '79. We have covered this in depth in recent Looking West columns. What is nice to see is that others agree with my policy of taking the initiative to build 220 activity to a level which would make a 220 maritime takeover a very hard task. Remember, today the old *73* slogan, "220—Use It Or Lose It!", is more important than ever before.

This brings us to a recent special issue of *220 Notes*. Entitled "A Special Action Bulletin," its contents outline what action you and I as individual amateurs can take to try to persuade our government to do an about-face in regard to 220 MHz at WARC. Also included is a suggested form letter to be used as a guide in requesting that action be taken by the FCC to keep 220 to 225 MHz exclusively amateur. The form letter was prepared by Barry D. Bayer K9CFV of the legal firm of D'Ancona, Pflaum, Wyatt, and Riskind. It takes the stand of supporting the Petition for Reconsideration on Docket 20271 filed by the 220 Spectrum Management Association of Southern California. The letter reads as follows:

Secretary,
Federal Communications Commission,
Washington DC 20554

Re: In Support of the Petition of the 220-MHz Spectrum Management Association of Southern California, for Reconsideration of Portion of Report and Order Docket 20271

I am a licensed amateur radio

Art Gentry W6MEP dusts off the original K6MYK receiver.

Continued on page 155

OMNI HAS IT *ALL*. All the advantages and capabilities, all the new conveniences and new levels of performance you need, whatever your HF operating specialty. All built-in, ready to use.

***ALL* SOLID-STATE.** All the advantages of total solid-state from the pioneer of HF solid-state technology. Reliable, cool, stable — from receiver front-end to transmitter final.

***ALL* HF BANDS.** From 160 through 10 meters (and all the crystals) plus convertible 10 MHz and "AUX" band positions for possible future needs.

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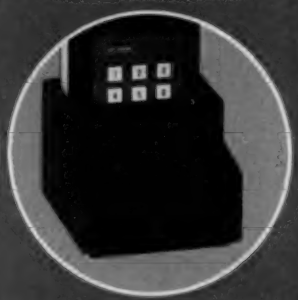

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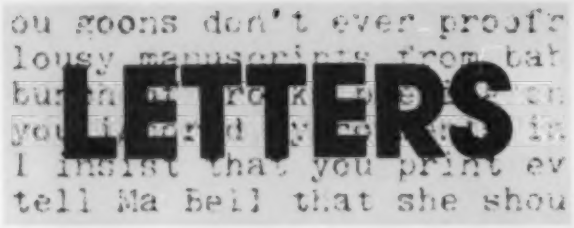

FREE SPEECH

Recently, the world has witnessed the worst nuclear accident in the history of the United States. On the east coast, and especially in central New Jersey, this incident has made residents aware of how vulnerable we are to next-door nuclear technology.

Amateur radio is now, as it has always been, a prime vehicle for the exchange of ideas and for open discussions between and among concerned licensed operators. For example: Senator Goldwater K7UGA converses with social studies students throughout the country, Columbia University W2AEE initiated the National Student Information Net (40m) during the 60s, and so on.

Since then, however, something has been added to amateur radio. State-of-the-art technology (but not state-of-the-art thinking) has produced the repeater—that wonderfully-efficient contraption capable of fostering human interaction and "communications."

Amateurs throughout the country in the style of "New Directions Radio" are discussing the issues, learning from each other, and forming views which may, in the future, preserve not only amateur radio, but a large proportion of the population as well.

Repeaters with their associated control operators, in many cases, *prevent* communication from taking place. Witness: a discussion of events on the 147.645/147.045 Asbury Park repeater between Bob WA2DEX and myself, WB2MIC. The topic of discussion was the events which took place the previous day in Lacey Township during a scheduled debate between the Jersey Central Power and Light Company and the Safe Energy Alternative Alliance. One individual of the SEA Alliance was arrested while questioning a plainclothes police officer who was recording license plate numbers. The legality and purpose of this officer's actions were described and discussed. Bob is familiar with such matters.

At this point, some true American (protector of free speech and Mom's apple pie) touchtoned the repeater off the air without identifying the transmission—breaking the law, in fact! Whether in self-preservation or as an expression of neo-fascism, this individual deliberately violated an FCC ruling, and did not possess the courage, decency, or intellectual fortitude to explain or admit his actions. The only alternative was to complete the QSO on the repeater's reverse-frequency pair.

There is no argument or debate over the right of a control operator to shut down a repeater. The concern is that such an important issue as nuclear power now has individuals who consider it a controversial topic—one that is taboo.

Let free speech prevail! Let the basic tenets of this nation stand, not only throughout the country but throughout amateur radio as well. After all, ham radio is part and parcel of our entire framework of freedom. Let the open forums happen.

Finally, it is easy to identify the ham neo-Nazis and all they represent by simply engaging in a friendly open dialogue with smatterings of relevance. They'll run and hide, only to plot behind the curtain of the executive committee meetings. There they feel important, in a world and modified hobby that is so far intellectually removed and unaware that the only consolation is peer friendship and closeness. Watch them; observe them; identify them; but most of all, feel sorry for them. But make certain that your views and your right to search for a meaningful QSO are not repressed!

Jozef Boniakowski WB2MIC
Neptune NJ

THE IARL AND TAPES

Regarding your conception of the IARL, please go for it, as you have my support. I am so tired of hearing the League "line" at the hamfests and in their magazine. It seems ludicrous to think that people who can sink as much money as they do into their hobby can't afford another $10, or more, a year to protect their interests, and regardless of League claims, lobbying is the *only* way to do that. Perhaps you're correct about the contests being the way to establish visibility. But, as an avid contester, I feel there are enough contests now, and setting up more may cause us to lose support from those who really dislike contests. It may also tend to cloud the main purpose of the organization. In any event, I hope you'll be ready to go when the time becomes right.

Perhaps you're tired of hearing success stories about your code tapes, but I'm going to relate one, anyway. Two friends of mine, one a Technician and one with an Advanced ticket, were preparing for FCC tests at a local hamfest. I gave the 20-wpm tape to my friend with the Advanced, and subsequent QSO-type tests that I sent him on the air confirmed that he would have no trouble with the test. My Tech friend has been away from code for so long that it looked like a real challenge.

I started him off with your beginner's tape and then gave him the 13-wpm tape. His progress seemed somewhat slow, and he further seemed to have difficulty when I sent him QSO-type tests because he would tend to read the copy and get lost. So I set my sending/spacing to match your 13-wpm tape and made up several QSO-type tests with questions for him, so he would have a better idea of what to expect at the actual test. At the hamfest, I learned early that my Advanced friend had passed his code test; I waited like an expectant father to see if my Tech friend had passed his 13-wpm test. He finally emerged all smiles, as he had passed the test—at 20 wpm!

While I don't recommend using the 13-wpm tapes to prepare for the Extra, this should give you an idea of the margin of safety in the tapes.

R. Michael Reed K9UP
Wolbach NE

SLAMMING

I got to the point when I had to write. I got my Novice ticket in December of 1976, my General in October of 1977, and my Advanced in June of 1978. I have had a subscription to *73* and *QST* since that time and think they are both very good magazines. I just got tired of you putting down the ARRL. Anybody who does something will make mistakes; maybe that's why you don't.

I have yet to see any other magazine cut the others down like you do *QST*. You just can't seem to resist a chance to put the slam on them. I don't know what your personal grudge is against them, but I do think it's about time you started using your editorial for other things besides devoting 75% of it to knocking the ARRL.

I have never been able to find W2NSD/1 giving code practice on the air. As far as the 50-year-old code tapes by the ARRL are concerned, I learned the code in one week from it. You say you dislike putting in the commercial for *73* tapes, but you still put it in, didn't you? I am going to get the *73* 20-wpm tape and, if it's as good as you say, I should be able to pass the Extra code test after the first time through, since it took a week with that no-good ARRL 50-year-old tape.

In your January issue, you say *Radio* magazine had better projects by far than *QST*. Why? Because you don't like *QST*?

I made a few projects out of *QST* and they worked right the first time. So far, I haven't found anything in *73* I wanted to make. So does that make *QST* by far the better magazine?

Wayne, I think it's time you started working with/for amateur radio instead of against *QST* all the time. You can start by stating in your editorial what you and *73* are doing for amateur radio, just to refresh our memories.

I don't really expect to see this printed in *73*, but I just thought I would let you know my feelings. If I were knocking *QST*, I'm sure it would get in print.

Best regards to you and yours, Wayne; 73s for now.

Gordon Traskos WD8DWO
Milford MI

TRAM DIAMOND 60

I have been keeping fairly close tabs on your articles on CB-to-10 conversions, but I must have missed one, because I haven't seen anything on the 23-channel Tram Diamond 60 SSB rig. You have a great mag. Keep it up.

Larry Seymour WB9UFT
Mahomet IL

Hang in there, Larry. Your rig will be coming up.—Jeff DeTray WB8BTH, Assistant Publisher.

OVERVOLTAGE

Although few hams build their own transmitters and receivers as in the days of AM, there is much home brewing in the area of station accessories—keyers, computers, test equipment, etc. Power supplies are popular to build so that the 2-meter rig can be used at home as well as in the car. Power supply circuits are so common and many hams have a false sense of security, particularly with the "new" 3-terminal regulators with thermal shutdown, current limiting, etc.

Unfortunately, overvoltage protection is almost universally avoided. For an adjustable regulator, it is complex, but for a fixed voltage or limited range supply, it is quite simple.

Check the reference books. An SCR, resistor, and zener are about all you need, and prepackaged circuits are available commercially and surplus. A dollar or two is pretty cheap insurance when you consider how a blown regulator could do many dollars of damage to that 2-meter rig, computer, or whatever.

Personally, deleting overvoltage protection for solid-state circuits is a crime which I hope never to commit. But check the articles; there are a lot of power supply circuits waiting to prove the point.

E. P. Rolek K9SQG/8
Dayton OH

COME ON UP

Come on up—the air is nice and clean. Don't let all the articles published about 220 MHz scare you. My friends and I here on Long Island have enjoyed this band for quite awhile; we need support now. So, if you have a 220 rig, please use it.

Ed Belnlich WB2IBQ
Whitestone NY

INFLATION

Don't let this inflate your ego, but it must be said that your magazine gets better with each issue.

I got quite a kick out of the recent letter you printed from (my friend) Merrill Eidson of Temple TX. (He's one of my crystal suppliers for those ¼-inch thick AT-cut blanks and crystals for radiobeacon equipment at Alaskan airports. He's the *last one* on the continent who makes up these very important crystal units in the old FT-164 3-inch round white ceramic holders with two nickeled studs protruding.) But I agree with you as being right on in criticizing the ARRL.

F. W. Anderson W7AR
Seattle WA

MORE ON TAPES

Around the middle of January, I received your 20- and 25-wpm code tapes. At the time I received them, you expressed an interest in the amount of time I spent going from the General class speed to the Extra class speed.

The total time I spent was seventy-one hours. I am able to copy the 25-wpm tape now with an error rate of about 3%. The difficulty of the groupings and the added 5-wpm speed was just what I needed to push me into the 20-wpm plain text required by the FCC.

Without the skill I acquired from the tapes, I'm sure I could not have passed the code test. I think they are excellent, and I would certainly recommend them to anyone wishing to upgrade.

Larry L. Sias N0ASV
Kansas City MO

BACKSTABBING

Recently, a friend loaned me an October, 1978, copy of *73* (the first that I have read in years) to review info contained in the article, "Mighty Mods for the 820S." I was very interested in your editorial on "a woman ARRL director." I have been following the action on Mary Lewis vs. the ARRL, Thurston, et al, and, while not having all the details, I always felt there was backstabbing, etc. As you probably know, HQ has received two petitions from Northwestern Division members. One requests that ballots be released for election of Director, and the other asks that Vice Director Mayer K7BT be appointed interim Director until the election takes place. You will note from minutes of the January 24-25, 1979, Board of Directors meeting (March, 1979, *QST*), Vice Director Mayer apparently was not allowed by Thurston to attend (out of Division funds), although 10 other Division Vice Directors did! With regard to the last paragraph of that portion of your editorial, I absolutely agree.

Walter R. Joos W6EKM
Vacaville CA

BIG PROJECT

With your reputation for advancing the amateur radio field, I would like to suggest a booklet that would be of great use to the beginner in this field. Namely, an evaluation of amateur equipment for the past fifteen or twenty years, which would include the good and bad points of each, the original cost, possible current value, and some judgment of the equipment.

If you and your associates could work this out, it could be of value for the beginner in buying his first or successive sets.

Don Hurley VE3HAN
Brighton, Ontario

That's an awfully big project, Don. Does anyone want to take on this project?—Jeff DeTray WB8BTH, Assistant Publisher.

GALLED

I am a new Novice. I have bought $50 worth of books which I study at least 8 hours a week. I subscribe to both *73* and *QST*. I *am* going to get that General. I am building a 40-meter QRP rig designed by a local ham, but I do have a problem which you seem to be unaware of.

73, *QST*, and all the manufacturers do not realize that the typical new Novice has limitations as to what he can do. I would like very much to build the Mini-Miser receiver in the *Handbook*. The assembly of parts on boards offers no problem, but I cannot manufacture PC boards, the shielding, and the cabinet. Therefore, it won't be built and we both lose.

Another thing that galls me is the way your publication lacks simple and thorough articles for the Novice. Maybe when I get my General, I will be equally arrogant. I hope not.

Nate Bushnell KA0DGN
Littleton CO

SMALL PROBLEM

I read your March, 1979, article on the universal alarm circuit. It came out just at the right time. With high water levels during the spring thaw, water seepage into the basement started to become a problem. If I had this early warning system built, I could rectify the situation before it caused any damage.

I went down to the local parts emporium and picked up a HEP C4001P McMOS chip. It states on the package: "Pin-for-pin replacement for CD4001A," which is what the project called for. There was only one thing overlooked and that is the type of gate HEP thinks a CD4001A is. Their chip is a quad 2-input NAND gate which, of course, is not correct for the alarm. If you have to use the HEP line, get their C4000P which is a quad 2-input NOR gate, even though HEP thinks that it is a "pin-for-pin replacement for a CD4000A."

Now that this small problem is out of the way, the alarm is complete and works great.

Dave Faucher WA1UQC
Collinsville CT

THANKS

Recently, I was successful in obtaining my Extra class license. Many thanks are due to the editors of *73 Magazine* who put together that TAB book, *Amateur Radio Extra-Class License Study Guide*, which I used as the basis for my self-conducted study program in amateur radio theory and practice over the past several years.

I found the topics introduced there to be an excellent starting point for study of the extensive literature surrounding amateur radio. I undertook this as a surprisingly-enjoyable pastime whenever I found the time to continue with it. As a result, I have been able to reach the point where I am confident that I can be of considerable assistance to the ham fraternity and the public which we serve.

Thanks are also in order for the *73 Magazine* code tapes which I found helpful in brushing up on the 20-wpm code speed needed for the Extra class license exam.

Thomas C. Kipps KA6Z
Fresno CA

QRP ZONE

We're in the process of taking the advice of K5UKH (CB to 10—part XV, November, 1978) and converting a currently-discounted ($34.88 each) Realistic walkie-talkie, Model TRC-201, to ten meters. This unit is identical to the TRC-180 which Tom Murphy K5UKH modified. The receiver in this unit is unusually hot.

International Crystal has the correlation for providing us the pair for 29.000 MHz. Another unit, the 5-Watt TRC-208 with 6 channels, is tempting as it would provide a tight band of 6 channels from 29.000 through 29.050 MHz for QRP operation. A 12-volt power cord plugged into the car lighter liberates you from dying carbon batteries or flagging nicads.

This is the time, Wayne, to stimulate hams into honoring and using a QRP zone, because there are already such large areas on ten for other modes of transmission other than AM.

I would welcome correspondence from interested hams. Service bulletins ($2 each) are available through Radio Shack stores.

F. W. Anderson W7AR
8041 31st Ave. N.W.
Seattle WA 98107

ICOM EAST

When a company that advertises in your magazine performs a service which is far beyond the expected, with courtesy and a sense of dedication, I felt that you would like to know about it.

First, let me assure you that I have been so delighted with the products and service of Icom East, Inc., that I have added

Continued on page 158

Microcomputer Interfacing

Jonathan A. Titus
Christopher A. Titus
David G. Larsen
Peter R. Rony

PREPARING YOUR PROGRAMS

One of the problems facing many microcomputer users is the preparation of software for their particular applications. The software examples which we have provided in past columns are short enough to have been put together or *assembled* by hand, i.e., we translated each mnemonic into its octal, hexadecimal, or binary equivalent. Addresses for jumps, calls, and input/output devices are easily added or changed since the computer programs are short and the addresses are probably listed in sequential order on the rough draft. Unfortunately, not all software preparation is this easy. Many application programs can be many thousands of steps long. This column will initiate a discussion of the aids available for microcomputer program development.

One of the biggest problems in software development is the clear, concise statement of the problem and how it is to be solved. All of the desired results, inputs, outputs, and the complete program flow, including all decision-making steps, must be considered before the programming is started. This can be in outline or block diagram form, but a flowchart will prove to be much easier to follow. A typical flowchart is shown in Fig. 1.

After the problem has been well thought out and a solution put in flowchart form, a decision must be made. Is the program short enough to be easily translated by hand? In many cases, particularly where the programs are simple, hand assembly makes sense. In other cases, software development aids called *editors* and *assemblers* are faster and more efficient. To understand how editors and assemblers work, let's consider the process used to put together this column.

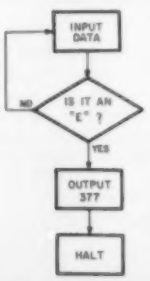

Fig. 1. Typical flowchart.

The first step is an outline of the subject so that we can cover it well in the short column format. A handwritten copy is then typed, corrected, retyped, and perhaps corrected and typed a final time. The illustrations and examples are formulated and drawn separately. This is the *editing* process. When writing a column, it is best to avoid references such as, "the example below" or "the table on the following page." When the column is composed or *assembled*, references to Table 1 or Fig. 4 are much easier to follow.

Computer software is developed in much the same way. An editor program is used, either on a microcomputer or a time-sharing system, to edit the individual program steps. The editor program can correct program steps, change steps, and insert and delete steps just as an actual editor can do with a manuscript. The editor program is generally unaware that you are writing a computer program, since you can use most editors to write a letter, prepare mailing lists, etc. When using an editor to prepare a program in mnemonic form, *symbolic addresses* are often assigned to software tasks within the program. In this way, the actual value of the addresses for subprograms or subroutines is not needed. Just as we can refer you to Fig. 4, the program may similarly refer to the letters, LOOP, as the starting address of a time-delay loop. Allowing us to use symbolic addresses for program steps means that the program may be changed without regard to the actual numeric values of addresses.

The assembler program must be such that it accepts information from the editor and generates an output in a form compatible with your computer. Just as you assemble short programs a step at a time, so does the assembler. The assembler contains a table of mnemonics and their equivalent values. For example, an 8080 assembler would translate an MVIA instruction into 076 octal. The assembler also assigns real 16-bit addresses to your symbolic addresses, such as LOOP. When using symbolic addresses, you must be sure to have a program step for each symbolic address, and you must assign an address if you use a symbol. You cannot assign the same "name" to more than one address. Most assemblers will recognize a *redefined symbol* or an *undefined symbol* and will produce an error message to let you know what needs to be corrected.

The final assembler output will be in punched paper tape, cassette, or disk form ready to run on your system. Most assemblers will also produce a listing of the program showing the address of each step, the data in each successive location, a symbolic address name, and the mnemonic, plus any comments. A typical assembler output is shown in Table 1.

After a program has been assembled, it will probably have to be debugged to get it to operate properly. The program checkout and debugging can be painful without additional software "tools." Computer control panels often prove useful, but reading binary codes can become tedious, and there are many computers without external controls and readouts. As an alternative, there are *debugging programs* available for most microcomputers which allow you to charge instructions, list blocks of data or instructions, and single-step through a program one instruction at a time.

One feature of many debug programs is the ability to establish a *breakpoint* in the software being tested. When the computer reaches a breakpoint, the instruction at that address is executed and an output device, such as a teletypewriter, lists the contents of important, internal CPU registers. Breakpoints are very useful since they indicate not only that the computer reached a certain point in the software, but also what the computer was doing when it got there. If a breakpoint is set in the normal program flow and is not reached, there is something wrong with the program. In this case, the breakpoint would be moved closer and closer to the start of the program until the error is found. When the error is found, it may be corrected by using the debug program to change an instruction, data, etc.

Once the program is operating correctly, the debug program should have the means of saving it on paper tape, a cassette, or another medium. It should also be able to read such

Continued on page 154

```
                        *003 000
003 000 061   START,  LXISP   /SYMBOLIC ADDRESS OF START
003 001 377⊕          377
003 002 000           000
003 003 333   LOOP,   IN      /INPUT DATA FROM PORT 5
003 004 005           005
003 005 376           CPI     /COMPARE IT TO 026
003 006 026           026
003 007 312           JZ      /IF IT MATCHES GO TO "DETECT"
003 010 015           DETECT
003 011 003           ⊕
003 012 303           JMP     /IF IT DOESN'T MATCH, GO TO
003 013 003           LOOP    /LOOP AND CHECK AGAIN
003 014 003           ⊕
003 015 171   DETECT, MOVAC
003 016 323           OUT
003 017 007⊕          007
003 020 166           HLT
```

Table 1. Software example showing a typical assembler output.

GLOSSARY

Editor: A program that allows edit functions such as addition of a line or character to a program, insertion, deletion, etc. It permits you to alter your program. The input data could be anything from programs or reports to raw instrument data.

Assembler: The program that converts the assembly language code into machine code, accepting mnemonics and symbolic addresses instead of actual binary values for addresses, instructions, and data.

Monitor: A program which controls the operation of the various programs available. The monitor will be able to access the editor, assembler, or other programs.

Debugger: A program which allows the user to observe the program flow and the results of the program's operation in a step-by-step mode. A debugger may be used to change data or instructions, alter registers, etc.

Breakpoint: A special instruction which may be inserted in a program to break off the normal program control and return control to a debug-type program. When a breakpoint is executed, the debug program will indicate what the computer was doing at that point.

Cross-Assembler: An assembler program which will generate the binary code of a program for a computer other than the type it is being used with. For example, an 8080 cross-assembler might operate on a PDP-8 minicomputer.

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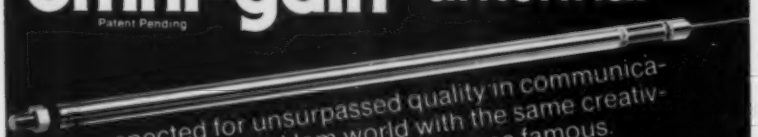

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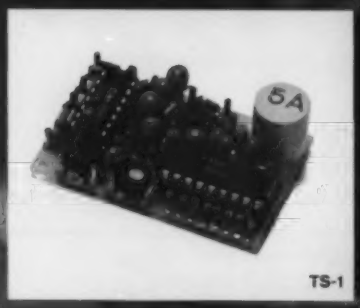
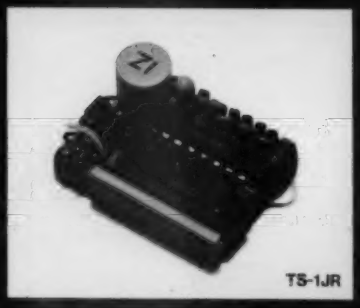
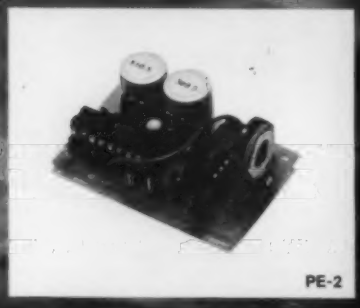
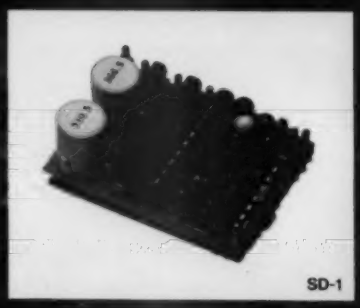


TS-1



TS-1JR


PE-2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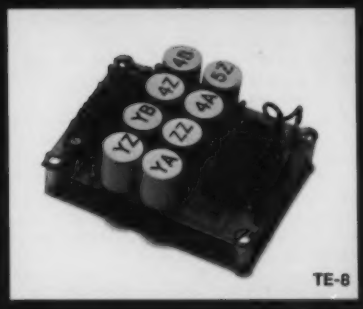
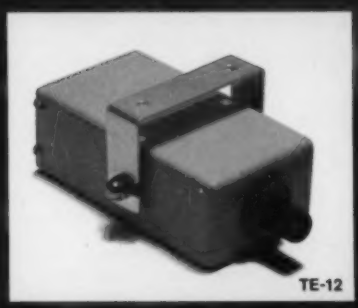
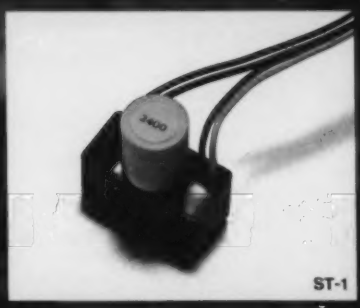


TE-8


TE-12



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MINNESOTA QSO PARTY
Starts: 1800 GMT June 2
Ends: 2359 GMT June 3

This year's contest is sponsored by the Heartland Amateur Radio Club. There are no mode or time restrictions, but only one transmitter is allowed in operation at any one time; no crossband contacts are allowed. Novices compete with other Novices, Technicians with other Technicians. Novices and Technicians must identify their license class when sending their call as "/N" or "/T". Phone and CW are considered to be the same contest; please score as such. Net QSOs are not valid.

EXCHANGE:

RS(T) and MN county or ARRL section/country.

SCORING:

MN stations multiply total of points by the number of sections plus DX countries (W/VE excluded). Others multiply QSO points by the number of MN counties worked (87 maximum). Score one point per phone QSO and 2 points per CW QSO. Novices/Technicians count 5 points per QSO. Contacts with HARC station WB0TTZ count 10 points per QSO on each band.

SUGGESTED FREQUENCIES:

CW—28150, 28050, 21050, 21150, 14075, 7075, 7125, 3725, 3600.

Phone—28700, 21400, 14300, 7275, 3950. WB0TTZ will also be operating RTTY on each band.

ENTRIES & AWARDS:

Include a check sheet for each band/mode used if you make 50 or more contacts. Logs must include date/time (GMT), bands, modes, and exchanges. Usual disqualification criteria and classes of awards, plus county awards to MN stations with 10 or more QSOs. Logs must be postmarked no later than July 1st; include an SASE for return of awards and contest summary. Send to HARC, c/o Scott Nelson WD0EFZ, 421 W. Wisconsin Ave., Staples MN 56479.

SOWP 4th ANNUAL CW QSO PARTY

The SOWP 4th Annual CW QSO Party is sponsored by the Society of Wireless Pioneers (SOWP) and will be held from 0000Z on June 6 through 2359Z on June 7. There are no formal requirements except an exchange of name, membership number, and QTH. Suggested frequencies are 55 kHz (±5 kHz) up from the low end of each amateur band. Novices will operate in the center of each Novice band. Members who can only participate part-time are requested to make their calls on the even hours during the period. To optimize long-distance contacts, it is suggested that ten and fifteen meters be used from 1400 to 2100 hours Z. The call will be CQ SOWP. A special certificate will be available to all members who contact a minimum of ten other members during the period. Requests for the certificate must include a list of stations contacted, dates, times, and membership numbers. In addition, an SASE must be included. Certificates will be issued by the V.P. for Awards, Manuel "Pete" Fernandez W4SM, 129 Hialeah Road, Greenville, South Carolina 29607. Requests must be submitted not later than 30 June 1979.

DAFG SHORT CONTESTS FOR 1979
SW (80 and 40 meters):
Saturday, June 9, 1300 to 1600 GMT
Sunday, September 9, 0800 to 1100 GMT
Saturday, November 24, 1300 to 1600 GMT
VHF (2m and 70cm):
Sunday, June 10, 0700 to 1100 GMT
Saturday, September 8, 1200 to 1600 GMT
Sunday, November 25, 0700 to 1100 GMT

The DAFG sponsors this year's short contests and welcomes participation of all RTTY amateurs both inside and outside of Germany. There will be an SW and a VHF contest, both contests being scored separately. The contest is split into 5 single contests within the year. After closing the 5th single contest, the winner of the year in each classification will be announced. Note: The official rules were received too late to list the dates for the first two weekends in January and March.

General call is "CQ DAFG CONTEST." On SW (80 and 40 meters) after each QSO, the station having called last keeps the frequency. The previous holder should QSY. This rule is not valid for the VHF part! Each station may be worked once per band. Contacts via repeaters are not valid. Classifications include: SW—Class A: SW stations above 200 Watts input; Class B: SW stations up to 200 Watts input; Class C: SWL stations. VHF—Class D: VHF stations.

EXCHANGE:

RST, QSO number starting with 001, name, and QTH.

SCORING:

SW—Each completed QSO counts 1 point on 80 and 40 meters.

VHF—Each completed QSO counts 1 point per each 10 km distance on 2 meters and 3 points per 10 km on 70 cm. Each different prefix per each band will be counted as a multiplier. Final score is QSO points multiplied by the total of multipliers.

ENTRIES:

Logs must contain call, name, and complete address of participant in block letters, classification, time (GMT), call, QTH of partner station, RST and QSO number sent/received, band used, and number of prefixes worked. Show final score; logs without final score will count as checklogs. For SWLs, scoring is the same as above; the same station may be reported a maximum of 5 times. Instead of message received info, the SWL should report call of partner station (worked). The results will be published in the news bulletins of the DAFG, in *RTTY Magazine*, in the DARC magazine, and in foreign courtesy publications. Your log should be in the hands of the contest manager not later than 20 days after closing each single contest. Each later incoming log will count as a checklog only. All decisions are final. Send entries to: Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee 1, West Germany.

All non-DL participants will receive the results of each part of the contest by regular mail. An award will be given every participant at the end of the year. Special plaque for the top scorers in each classification stated in the annual results.

ALL ASIAN DX CONTEST
Phone: 1000 GMT June 16 to 1600 GMT June 17
CW: 1000 GMT August 25 to 1600 GMT August 26

The purpose of this contest sponsored by the JARL is to increase the activity of radio amateurs in Asia and to establish as many contacts as possible during the contest periods between Asian and non-Asian stations. All amateur bands below 30 MHz may be used. Entry classifications include: single operator, 1.9 MHz band, CW only; single operator, 3.5 MHz band; single operator, 7 MHz band; single operator, 14 MHz band; single operator, 21 MHz band; single operator, 28 MHz band; single operator, multiband; multi-operator, multiband.

Power, types of emission, and frequencies used must be within the limits of your own station license. General call for Asian stations is "CQ TEST," non-Asians use "CQ ASIA." No crossband contacts are allowed. For participants in single-operator classes, never transmit two signals or more at the same time. For multi-operator participants, never transmit two or more signals on each

Continued on page 154

Calendar

June 2-3	**Minnesota QSO Party**
June 6-7	**SOWP CW QSO Party**
June 9	**DAFG Short Contest—SW**
June 9-10	**ARRL VHF QSO Party**
June 10	**DAFG Short Contest—VHF**
June 16-17	**All Asian DX Contest—Phone**
	West Virginia QSO Party
June 23-24	**ARRL Field Day**
June 30-July 1	**Seven-Land QSO Party**
July 4	**ARRL Straight Key Night**
July 14-15	**ARRL IARU Radiosport Competition**
	Colombian Independence Day Contest
July 28-30	**CW County Hunters Contest**
Aug 4	**DAFG 10 Meter Contest**
Aug 4-5	**ARRL UHF Contest**
Aug 25-26	**All Asian DX Contest—CW**
Sept 8	**DAFG Short Contest—VHF**
Sept 8-9	**ARRL VHF QSO Party**
Sept 9	**DAFG Short Contest—SW**
Sept 15-16	**Scandinavian Activity—CW**
Sept 22-23	**Scandinavian Activity—Phone**
Oct 13-14	**ARRL CD Party—CW**
Oct 20-21	**ARRL CD Party—Phone**
Nov 3-4	**ARRL Sweepstakes—CW**
Nov 10-11	**CQ-WE Contest**
Nov 17-18	**ARRL Sweepstakes—Phone**
Nov 24	**DAFG Short Contest—SW**
Nov 25	**DAFG Short Contest—VHF**
Dec 1-2	**ARRL 160 Meter Contest**
Dec 8-9	**ARRL 10 Meter Contest**

Faces, Places

The Heart of America Radio Club W0RR (Kansas City MO) provided communications at the 1979 Leukemia Telethon. Among the 35 ham participants were Camille Norton WB0YBA, John Bauerly WB0NKR, and Stephen Lufcy WB0LFY.

Last November, LIMARC (Long Island Mobile Amateur Radio Club) members erected three new ATV repeater antennas at their new Syosset, New York, site. The installation crew included (left to right) WB2KCD, WN2VVR, W2MVS, W2KPQ, KA2CLQ, W2TRP, WA2SHC, WB2WAK, N2FP, K2LIO, and WB2SDG. (Photo by K2JKX)

George Romanisky WA6WXD, Los Angeles County Sheriff, was on duty at the Pasadena Rose Parade on New Year's Day. At the time the picture shown was being televised on national TV, he was in QSO through the WR6ABW repeater landline linkup with repeaters WR7AKI, WR8ACC, and WR4ABR.

A few of the hams who pulled emergency duty at the Grumman Corporation's amateur radio station during the Iranian crisis were (front row, left to right) Dick Townes, Skip Courtney; (back row) Zac Zilavy, Ray Schubnel, Jim Kearney, and Jack Cottrell. (Photo by Rich Breunig)

(Left) This solar thermal steam electric generator array is under construction at the Jet Propulsion Laboratory's Pasadena, California, parking lot. A dedicated group of young people has been donating its efforts over the past eight years to build this device for the people of Pitcairn Island. When completed, the array will deliver 5-8 kW in good sun, hopefully allowing the islanders to stretch their increasingly costly supply of diesel fuel a little further. (Above) At the JPL ciub station W6VIO, Dick Piety K6SVP (left) made contact with Tom Christian VR2TC on Pitcairn. Present in the shack at the time was a group concerned with how to get a very large and heavy structure from the sea in Bounty Bay up a sheer cliff on Pitcairn onto the surface of the island. The group included the New Zealand Consul General for Los Angeles, Frank Muller (right). The consensus was that only a Chinook-type military helicopter would be able to accomplish the task. Any offers? (Photos by Dr. Norman L. Chalfin K6PGX)

RTTY Loop

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

This month we begin the third year of RTTY Loop. What better way to celebrate a birthday than to investigate once more the hottest topic around today: microprocessors in RTTY. A year ago we looked at reception techniques; this month and next will cover transmitting.

While RTTY transmission can quickly get complicated with various buffers and special function generators, our first efforts shall be directed at merely producing a program that takes keyboard input and converts it to standard RTTY output. We will hold other considerations for later and deal here with the code conversion, speed conversion, and interfacing.

Much as we did for RTTY reception, let's enumerate our goals in RTTY transmission: (1) input a character in ASCII from the keyboard; (2) convert that character to the Baudot equivalent; (3) maintain LTRS-FIGS shift appropriately; (4) put the character out at 45.45 baud (60 wpm).

There are also a few niceties we may like, such as downshift-on-space or automatic carriage return/line feed. We will try to incorporate these as the need appears.

The first step, inputting the character as ASCII from the keyboard, is straightforward. Essentially, all computers have an inputting routine, such as the MIKBUG™ INEEE routine, to accomplish this. The only requirement is that the routine mask off the MSB of the input. The ASCII that we use is a seven-bit code, and the eighth bit will confuse things.

Before we get too deeply into this in words, let's walk through the first flowchart, shown in Fig. 1. The keyboard input places an ASCII character into the accumulator. Values greater than $5F are tested for. These represent lowercase and, if present, would cause the table read to search out of the table. If the ASCII code is greater than $5F, it is converted to its uppercase equivalent by subtracting $20. This value is then used as an offset for an indexed search which loads the corresponding table value back into the accumulator. This Baudot-keyed value is either $00, $FF, $FE, or a representation of the Baudot character. If the latter, the format is as shown in Fig. 2.

While the conversion from ASCII to Baudot may at first glance seem to be rather formidable, it really involves the same kind of look-up table as the Baudot-to-ASCII transformation in the receiving program did. By encoding several loca-

Continued on page 156

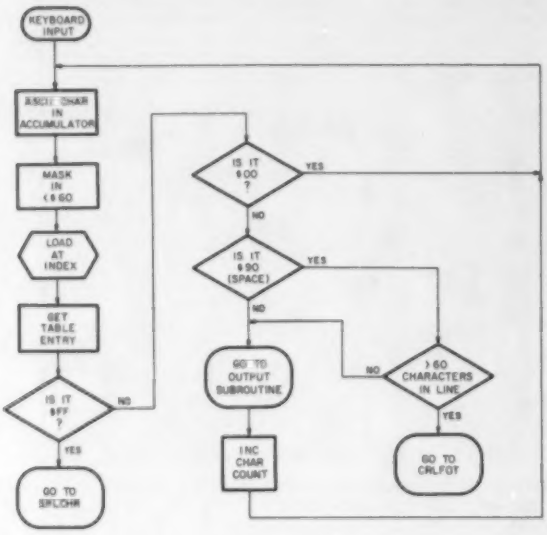

Fig. 1. Main program loop.

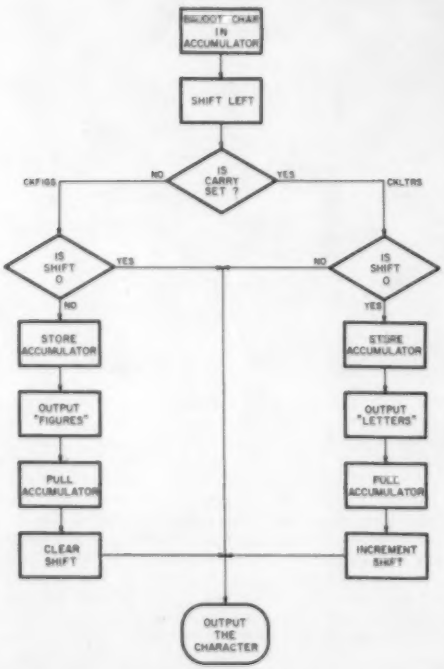

Fig. 3. Shift storage.

MSB:	1 = LTRS 0 = FIGS	
	1/0	)
	1/0	)
	1/0	) BAUDOT CODE
	1/0	)
	1/0	)
	0	
LSB:	0	

Fig. 2. BAUDOT encoding.

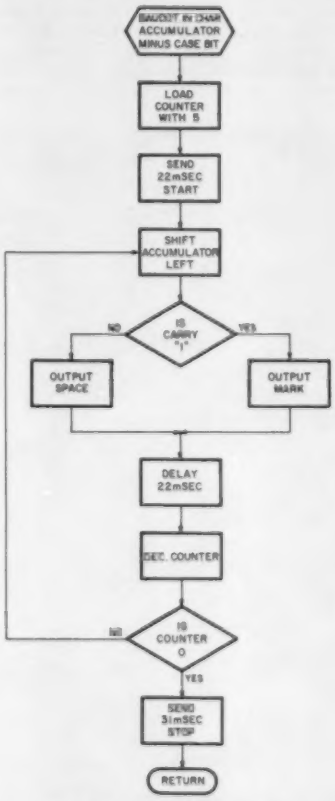

Fig. 4. BAUDOT output.

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DX

Chuck Stuart N5KC
5115 Menefee Drive
Dallas TX 75227

Summer is here—the summer of the greatest DX conditions since 1957. Those of you who have been around long enough to have seen a complete sunspot cycle know that it has not always been like this nor will it be like this forever. Perpetual sunspots exist only in DX Heaven. To you newcomers, we can only advise that you take advantage of your good timing and work everything possible while you can. In years hence at future club meetings, the newer generations will hasten to gather at your feet and listen to unbelievable stories of cycle 21.

DX PROFILE

This month we profile not a who but a what, the Northern California DX Foundation. If you are not a member, you are missing out. Drop a note to Box 717, Oakland CA 94604, for complete information on how you can become one of the deserving ones.

The NCDXF was started in 1972 by K6KQN. Its purpose . . . to assist radio and scientific events with funds or equipment. It would be supported by donations from those who benefit. It would provide a central point where funds could be collected and dispersed . . . after applications for assistance were carefully screened by the Board of Trustees.

The Board of Trustees would be a panel of responsible persons, prominent in the electronics industry or business world, having amateur radio (especially DX) for a hobby. They would give their services and counsel to the NCDXF at no salary or compensation in any form. That was the goal.

If you have worked everything, then all the Foundation can offer is the satisfaction of helping others. If the hobby has given you pleasure, put something back to help someone else. The list below has received aid from the NCDXF and must have given some of you a new country. Were any of them new for you?

1974: ARRL Foundation, VR3AG = Fanning, KP6KR = Kingman, OH2BH/OJ0 = Market, XU1AA = Khmer, KP6PA = Palmyra, W6WX/KJ6 = Johnston, and OSCAR/AMSAT Project.

1975: CR9AK = Macao, 3B8DA = Mauritius, JY8BH = Jordan, CT9AT = Madeira, C5AZ = Gambia, KC4NI = Navassa, OH0AM and OH0DX = Aland, SV1GA = Mt. Athos, HB0BZD = Liechtenstein.

1976: A35NN = Tonga, 9N1MM/7 = Nepal, ST2SA = Sudan, ST2SA/ST0 = So. Sudan, ZK2AQ = Niue, HK0AA = Serrana Bank, TA7ABK = Turkey, YM0AA = Geyser, VK9XX = Christmas Island, HK0AA = Bajo Nuevo, Moonbounce Expeditions—HK1TL = Colombia, So. America, K6YNB/KL7 = Alaska, N6NB = VHF states VT, RI, DE, WV, UT, NV. And we provided an SWL receiver to a boy with a terminal illness.

1977: KP6BD = Kingman, The Personal Foundation, 3B8DT = Mauritius, SU1IM = Egypt, KP6AL = Palmyra, VP8ON = Falklands, 4U1UN = United Nations Amateur Radio Station.

1978: PY0RO = St. Peter/Paul, ZL1BKL/K = Kermadec, K5YY/FH8 = Mayotte, D68AF = Comoros, FH8CY = Mayotte, YI1BGD = Iraq, ZS3 = Walvis Bay, VK9YS = Cocos-Keeling, ST0YY = So. Sudan, W0RJU/KP1 = Navassa, K5YY/ST2 = Sudan, FO0XA = Clipperton, CE0AE = Easter Island, LA1VC = Bouvet, ARRL IARU "Project Goodwill."

Application for assistance must come from the person or group directly involved. It takes too much time to deal with 2nd and 3rd party requests. And they must be processed through PO Box 717, Oakland CA 94604, not via a trustee.

Application processing time: The NCDXF has nine trustees that must vote on the requests. They seldom have meetings, so voting is done by telephone. Don K6RV, the president, calls each trustee long-distance (at his own personal expense) to poll the votes on various items. Allow plenty of time for processing.

Equipment donations are encouraged, but must be trouble-free. It is asking too much to expect the Foundation to find a repairman. You are the one that gets the tax receipt.

Membership: Anyone is invited to become a member. A minimum donation of $5 is required to cover membership certificate, etc. There are no yearly dues or demands, but the Foundation must have an influx of capital if it is to continue, so they encourage a yearly contribution. For USA tax purposes, they are classed as a private operating foundation, defined in Code Sect. 4942(1)(3), which allows up to 50% of your adjusted gross income to become a deductible contribution. If you are in a position to make a substantial donation, write for details.

Last month we showed you the SSB operating position at KV4AA. Above is the CW position from where most of the almost unbelievable 48,100 QSOs were made during 1978.

HEARD ON THE BAND

The Desecheo operation, KP4AM/D, was a roaring success with over 21,000 contacts made on all bands 2 through 160. The QSLs were expected to hit the mails in early May, so you should have yours in hand by this time. Although the operation received financial support from the Northern California DX Foundation, it is still several thousand dollars in the red. Those wishing to help out can direct their mail to the DX Club of Puerto Rico, PO Box 50073, Levittown PR 00950. Those taking part in the operation were KP4AM, KP4Q, N4EA, KP4DSD, KV4KV, and N4ZC.

EA6CE was a multi-operator effort in the recent ARRL DX Contest. They managed some 3,000 contacts in a forty-eight hour period and ended with better than 1.5 million points. QSLs should be directed to PO Box 31, Palma de Mallorca, Balearic Islands, Spain.

While we are reporting from Spain, we might mention that Fernando EA8CR sends word that permission has been granted for 160 activity from Spain. This includes the EA6/8/9 types as well, and, while there may be some restrictions in some areas, you should soon be hearing all the EAs on 160.

George Collins VE3FXT was mobiling around the US last summer and dropped in on the Fresno International DX meeting. George is planning quite a bit of DX activity in the coming years, including a massive effort preceding the 1984 Olympics. Plans call for a complete mobile station possibly set up in a light aircraft to move quickly from place to place. His itinerary of well over 100 countries will warm the hearts of many DXers. George has some 11,000 contacts from H5 and S8 and he reports that the gear for Vendaland is already in place.

Speaking of those new African homeland countries, you should be hearing Vendaland and Qwa-Qwa before the year is out. These two, along with H5, Bophuthatswana, and S8, Transkei, should be added to the ARRL DXCC countries list as soon as WARC 79 is history. They most certainly will be made retroactive to their independence dates, so go ahead and work them even though they won't count for a while. There is also the possibility that South Bophuthatswana will count separately from North Bophuthatswana, so work all the H5s you hear until you are sure you have them both. ZS6BOK/H5 was in South Bophuthatswana; H5AA was North.

IP5CJA, on during the WPX contest last March, was on Montecristo Island in the Tyrrhenian Sea, part of the Tuscan Archipelago. This is a wildlife conservancy like Desecheo Island and is administered by the Italian Department of the Interior. Only two operators are allowed on the island at once and for only four days. Although Montecristo Island would appear to qualify as a new country under the same "distinctively separate administration" that qualified Desecheo, the ARRL has so far rejected the Italians' claims.

W4BAA is looking to close out the logs for the 9L1JM operation from November, 1974, to September, 1978. The station has returned to Holland, so if you still need a QSL, it's now or forever hold your peace.

VQ9JJ and VQ9KK are on Diego Garcia for a long stay and plan to be active on 28545 kHz and 21352 kHz. QSL to W5RU.

That AX6 prefix marked the visit of Prince Charles to Western Australia on the 150th anniversary of settlement there in the old west.

Continued on page 158

IC-701, Your Synthesized Passport

Enter the exciting world of HF DX with ICOM's outstanding, fully synthesized **IC-701**. Globe-spanning QSO's are as easy as hook-up and tune-in. Complete installation requires only a good 50 Ohm antenna and an AC power plug-in. Your **IC-701** comes with everything else you need for beginning DX transmissions, including the matching **IC-701PS** external speaker and power supply, the fine **SM-2** base microphone, and even two built-in VFO's.

Turn on the power, and the world's at your single fingertip. The **IC-701** lets you scan all the Amateur HF bands from 160M to 10M (plus some MARS coverage above and below some of the Ham bands) with one finger. No more fooling around with two or more tuning knobs, and no complicated retuning when you QSY.

When talking on your **IC-701**, you get a 200 watt PEP input signal whose punch is significantly increased by the high quality built-in RF speech processor. This makes your 200 watts sound like so much more that we recommend you leave the speech processor on all the time.

For adding on frequency memory and remote frequency control, the **IC-701**'s synthesizer is completely compatable with ICOM's **RM2** remote computer controller: and with ICOM's optional **EX1** extention, you can operate with the **RM2** and a linear amplifier at the same time.

Nothing else matches the value and ease of the **IC-701**. Plunge into the excitement of HF DX now, and get the whole HF world with ICOM's **IC-701** LSI system.

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All ICOM radios significantly exceed FCC regulations limiting spurious emissions

New Products

DAIWA CN-720 SWR AND POWER METER

Take one look at the new Daiwa CN-720 swr and power meter and you'll realize that it's something unique among ham shack accessories. Unlike other meters, which display only one or two transmitter parameters, the CN-720 simultaneously displays three important quantities—forward power, reflected power, and swr—on a single dial face. Very convenient.

Actually, the concept of the Daiwa metering system is so simple that you'll wonder why someone didn't think of it before. Conventional units require the user to observe two different dial faces or else switch between functions in order to monitor two or more values. The Daiwa system puts two meter movements and three scales on the same dial face. The meter movements indicate forward and reflected power at the same time, which might seem like convenience enough, but Daiwa has gone a step further. In the area where the forward and reflected power pointers cross one another, there is a third scale designed to indicate swr. Simply note the point where the two pointers cross and swr can be read directly from the scale. Thus, you can monitor all three important quantities at the same time on one dial face. Believe me, this makes transmitter and antenna tuner adjustments a snap.

The front panel of the CN-720 contains a single control switch which is used to set the power range of the meter at 20, 200, or 1000 Watts. When rf is applied to the meter, one of three LED indicators is illuminated as a reminder of the power level you have selected.

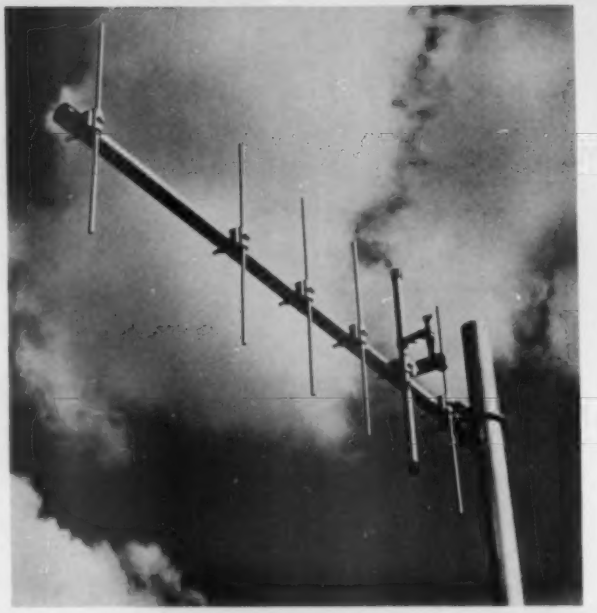
The rear panel features three SO-239s for connection of the station transceiver along with two antennas (or one antenna and a dummy load). A built-in slide switch allows selection of either antenna without resorting to an external coax switch—a definite plus.

The CN-720 is housed in a rugged all-metal enclosure measuring 7" W x 4¾" H x 5" D. An electrically identical unit, Model CN-620, is available in a more compact case measuring 6½" W x 3" H x 3¾" D. Both units are rated for legal limit power from 1.8-150 MHz. All features of the CN-720 are retained in the 620—the only difference is the size. Those wanting a large, easy-to-read meter would probably choose the 720. Where small size and weight are important, the 620 is a better choice. Styling is a subjective factor, of course, but I find these meters very attractive; they should look good in most any ham shack. *J. W. Miller Division, Bell Industries, PO Box 5825, Compton CA 90224.* Reader Service number B47.

Jeff DeTray WB8BTH/1
Assistant Publisher

BROADBAND UHF YAGIS

Cushcraft Corporation has announced 2 new broadband Proline 6-element yagis for UHF service. Both models offer 10-dBd forward gain, 20-dB front-to-back ratio, 10-MHz bandwidth, and 50-Ohm UHF connector termination. They come complete with hardware for versatile end-mount installations. Designated models P456-6 (450-460 MHz) and P467-6 (460-470 MHz), they require no tuning and are ideal for situations where relatively inexpensive yet durable antennas are required. For further information, contact *Cushcraft Corporation, PO Box 4680, Manchester NH 03108.* Reader Service number C67.



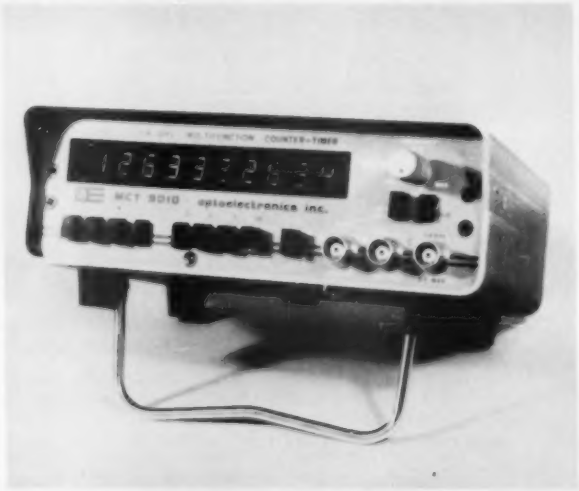
One of Cushcraft's new UHF yagis.

1.4-GHZ, 10-DIGIT FREQUENCY COUNTER

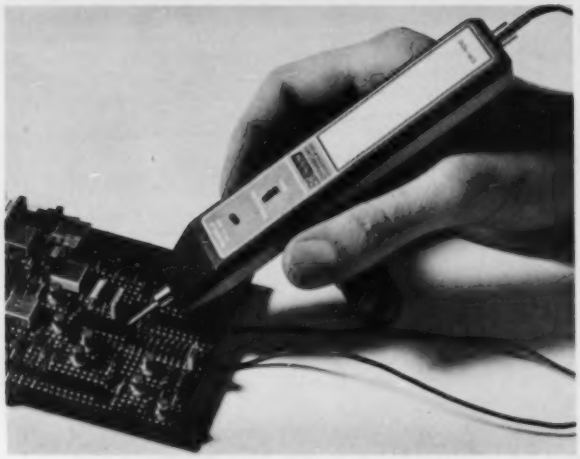
Optoelectronics, Inc., has just announced an all-new, top-of-the-line, ac-dc portable multifunction counter/timer. Dubbed the MCT 9010, this state-of-the-art unit has a most impressive list of features, all of which are standard, including a precision temperature-compensated 10-MHz crystal timebase (0.1 ppm, tcxo 17-40 °C) with an aging rate of less than 1 ppm/year guaranteed, four functions (frequency, period, ratio, and totalize), 8 gate times from .01 second to 20 seconds, a low-frequency multiplier for resolution of .001 Hz below 5 kHz, resolution to 1 Hz through 1.4 GHz, and a variable sensitivity attenuator with a typical sensitivity of 1-20 mV rms from 10 Hz to 1 GHz.

Provided with each MCT 9010 will be a "Certificate of Compliance" certifying the timebase stability, aging, and NBS calibration traceability. For further information, contact *Optoelectronics, Inc., 5821 N.E. 14th Avenue, Ft. Lauderdale FL*

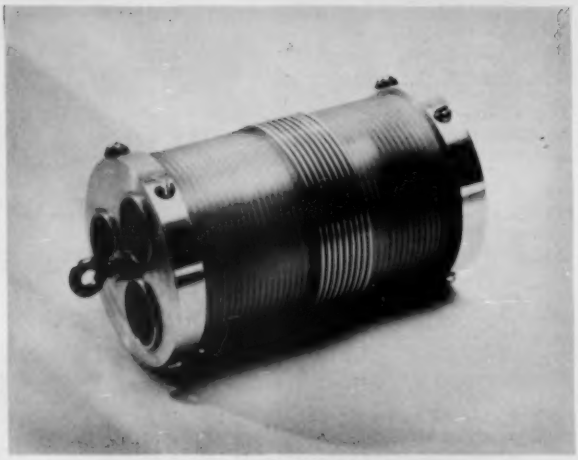
Daiwa's CN-720 swr and power meter.



Optoelectronics' MCT 9010 counter.



B&K-Precision's new digital pulser probe.



Unadilla's new KW-80 80-meter antenna trap.

33334; (305)-771-2050/1. Reader Service number O3.

MODEL HG-52SS CRANK-UP TOWER

Hy-Gain Electronics, a division of Telex Communications, Inc., has announced the Model HG-52 self-supporting tower. The HG-52SS is designed to support 9.0 sq. ft. of antenna area with winds up to 50 mph. This all-steel tower has the advantage of an improved guide system which allows the tubing to be open at each end, ensuring complete galvanizing and total moisture drainage.

The HG-52SS will accommodate standard rotators. A thrust bearing can be bolted to the top section to allow a 2-inch mast. For further information, contact *Hy-Gain Electronics, 8601 Northeast Hwy. 6, Lincoln NE 68505; (402)-467-5321.* Reader Service number H4.

NEW DIGITAL PULSER PROBE ANNOUNCED BY DYNASCAN

The B&K-Precision product group of Dynascan Corporation has just introduced a new digital pulser probe. The new unit, designated as Model DP-100, is designed as an aid to fast analysis and debugging of integrated circuit logic systems.

The DP-100 generates a single pulse in the "one-shot" mode or a 5-Hz pulse train in the continuous output mode. Simple to operate, the DP-100 can be used alone or in conjunction with a logic probe or oscilloscope. When the probe output is applied to a circuit, it will automatically pull an existing logic low to a high state or an existing high state to a low. By observing the change in circuit output, the user can isolate faulty circuits and components. Applied test energy is limited to only 0.33% of the normal power dissipation of a good device. This ensures that circuit damage cannot result from the DP-100 test procedure.

For full versatility, the DP-100 is compatible with DTL, TTL, RTL, and CMOS logic circuits. Operating power is derived from the circuit under test, so batteries are not required. Like other B&K-Precision products, the DP-100 is well protected against overvoltage or polarity reversal. The output (probe tip) is protected to ±35 volts and the input power leads are protected to ±160 V dc and 117 V ac.

For additional information, contact *B&K-Precision, Dynascan Corporation, 6460 West Cortland Street, Chicago IL 60635; (312)-889-9087.* Reader Service number B45.

80-METER ANTENNA TRAPS

Unadilla has added a pair of 80-meter antenna traps (the KW-80) to its line of 10-15-20-40-meter series. The KW-80 takes 1 kW, is weatherized, and is available for the CW band (KW-80C) or the phone band (KW-80F). For further information, contact *Microwave Filter Company, Inc., 6743 Kinne St., East Syracuse NY 13057; (315)-437-3953.* Reader Service number U9.

MODEL TH5DX FOR 10-15-20 METERS

Hy-Gain Electronics has introduced the newest member of its famous Thunderbird line of triband antennas. The TH5DX offers outstanding performance on 20, 15, and 10 meters. It features 5 elements on an 18-foot boom, with 3 active elements on 15 and 20 meters and 4 active elements on 10 meters. The TH5DX also features separate air-dielectric Hy-Q traps for each band. This allows the TH5DX to be set for the maximum F/B ratio and the minimum beamwidth possible for a triband antenna of this size. Also standard on this antenna are Hy-Gain's unique beta-match, rugged boom-to-mast bracket, taper-swaged elements, and improved element compression clamps. For further information, contact *Hy-Gain Electronics, 8601 Northeast Hwy. 6, Lincoln NE 68505; (402)-467-5321.* Reader Service number H4.

Ham Help

As a radio amateur, I like very much to experiment and try different approaches to various problems. I am sure that there are more persons, in many fields, who are doing the same thing: experimenting with various facets of scientific problems in the hope of finding a better/cheaper/more-efficient way of doing things, or doing things that supposedly cannot be done.

At this time, there is an organization being started to bring together, in one group, various clubs and individuals who might be called amateur scientists. The organization is called, aptly enough, the Amateur Scientist Research Organization. Anyone interested can find out more by writing to ASRO, PO Box 4, McMechen WV 26040. We will be glad to send him the latest newsletter and bulletin. There is no charge or obligation.

Also, there is a net planned for the ham members. We feel that this organization fills a definite need in the world of the amateur scientist. We are open for suggestions from all persons.

Richard S. Meyer WD8BJW
134 Jims Run
McMechen WV 26040

I have a military surplus unit labeled TYPE CFN-46ADT RF TO IF CONVERTER, SERIAL 737, A unit of model BP Radio Eqpt., Navy Dept.—Bureau of Ships, Farnsworth TV & Radio Corp. I would appreciate any information on frequency coverage, i-f output frequency, voltages, etc. Many thanks.

J. O. Dickinson W4LLF
1408 Monmouth Court West
Richmond VA 23233

I will be visiting the United States and Canada for 3 weeks in August of this year, and I would like to meet local amateurs as I pass through. Having the equivalent of a Technician's callsign, I do not know many hams stateside.

Being originally from VU2, I shall be bringing along some slides on VU2 and ZL and will be happy to talk about them. I shall be spending a week each in Concord CA, Point Pleasant NJ, and Toronto, Canada, with no fixed plans, so I would appreciate advice on local attractions, 2-meter repeaters, ham shops, etc. (All letters will be answered.) I have also been a broadcast-band SWL for some years and would like to hear from SWLs, too.

Ashok Nallawalla
PO Box 144
Dunedin, New Zealand

I need a February, 1950, copy of *CQ* to copy an article. I will return it to the owner in good shape. Thank you.

Richard E. Flarida K8BJA
2267 Star Route 183
Atwater OH 44201

Ham Help

I am interested in obtaining information on the World Radio Laboratories Model SB 175 transmitter. I am particularly interested in converting the DSB to SSB, and would also like to know about any other successful modifications that have been made to this unit.

I am also interested in obtaining a schematic on a digital frequency display for the FRG-7 receiver, using either an external frequency counter or a separate readout.

Rex D. Faulkner
3413 Covington Drive
Augusta GA 30909

I would like to get in touch with any hams who are interested in or own antique and classic cars, for the purpose of starting a classic car net on 15 meters. When writing, please list the car(s) (if any) you own.

Gary Carter WA4IAM
329 Oakdale Rd.
Rocky Mount NC 27801

I would like to get in contact with a ham in the Peoria, Illinois, area who could help me with code practice for my General ticket.

Patrick Butler
3208 W. Greenwood Pl.
Peoria IL 61615

Does anyone have a schematic for the Hallicrafters T.T.O. Electronic Keyer, Model HA-4? I will gladly pay copying cost and postage.

Bill Hurt WD4RMA
Rt. 1, Box 212A
Zirconia NC 28790

Anyone interested in starting an informal net for hunters, shooters, and fishermen on about 21,400-410 MHz daily at 1500Z? Drop me a card or meet on frequency.

Art Santella K1VKO
43 Seaview Ave.
East Norwalk CT 06855

I am interested in becoming a QSL manager for any DX station.

Dennis Younker WA6OYV
45255 Raysack, Apt. 2
Lancaster CA 93534

I am trying to make a Gonset GSB-2 Model 900B with a Model 901A work again.

I need a manual, a schematic, and alignment info.

I will be glad to pay any reasonable cost for copies and mailing. Thank You.

R. Maag K6IUP
40103 87th St. W.
Leona Valley CA 93550

I am very curious to know if there exists an unconverted, untampered with, working or not, Motorola HT-220 for sale which costs less than the national debt.

David Pilipauskas WB9HPJ
6649 S. Fairfield
Chicago IL 60629

I would like to purchase a manual or schematic for a Kaar UHF transceiver (model 12TR510A), which I plan to convert to 440 MHz. The manufacturer is no longer in business.

Norris Saari W7LAP
13535 53rd Ave. So.
Seattle WA 98168

I would like to hear from anyone using the new Atlas RX-110 and TX-110L combination. I'm interested in the comments and experiences of others who are using this setup.

Keith Arnold N8AQR
1273 Erickson Ave.
Columbus OH 43227

Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

UPPER HUTT NZ
JUN 1-4

The 1979 Annual Conference of the New Zealand Association of Radio Transmitters will be held on June 1-4, 1979, at Upper Hutt, New Zealand. Visitors are welcome to attend this conference. For registration forms, contact the Secretary, 1979 Conference Committee, PO Box 40-212, Upper Hutt NZ.

ST. PAUL MN
JUN 2

The North Area Repeater Association, Inc., will hold its Amateur Fair '79 on Saturday, June 2, 1979, at the Minnesota State Fairgrounds, St. Paul, Minnesota. This is a swapfest and exposition for amateur radio operators and computer hobbyists. There will be free overnight parking for self-contained campers on June 1st only. You may sell from your car in the giant flea market or from the available inside space. There will be AMSAT and microprocessor exhibits, FCC, ARRL, Minnesota Repeater Council booths, and many prizes. Admission is $2.00. For information or reservations for commercial space, write Amateur Fair, PO Box 30054, St. Paul MN 55175.

WENATCHEE WA
JUN 2-3

The Apple City Amateur Radio club will hold its Ham Fest on June 2-3, 1979, at Rocky Reach Dam, 7 miles north of the city on Highway 97, Wenatchee, Washington. Registration fee for amateurs is $3.00 (which includes one ticket for the prize drawing), $1.00 for non-amateurs, and children under 12 are free. A banquet dinner will be held on Saturday night at $5.00 per person. Free camp/trailer space will be provided at the park. Featured will be equipment displays, a VHF tune-up clinic, an arts and crafts show/sale, a swap shop, a photography display, exhibits, a tour of the Power House, a film on the Life of Thomas Edison, and a potluck dinner on Sunday at 1:00 pm. For information and reservations, contact the Apple City Amateur Radio Club, 713 Grandview Avenue, Wenatchee WA 98801.

ISLIP LI NY
JUN 3

The Long Island Mobile Amateur Radio Club, Inc., will hold its Long Island Hamfair '79 on June 3, 1979, from 9:00 am to 4:00 pm at the Islip Speedway, on Islip Avenue (Rte. 111), just one block south of the Southern State Parkway, Exit 43, or south on 111 from Exit 56 of the Long Island Expressway, Islip, Long Island, New York. There will be over 250 exhibitors. General admission is $1.50 and exhibitors' admission is $3.00 per space. Wives, sweethearts, and children under 12 are admitted free. There will be many door prizes available for all ticket holders. Talk-in on 146.25/.85 and .52. The rain date

Continued on page 164

Reader Service—see page 195

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✓ Reader Service—see page 195

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Richard C. Jaeger K4IQJ
1599 Gonzalo Road
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Several years ago, I decided that a digital readout for my R4B receiver would be a worthwhile addition to my shack. After reviewing existing articles describing counters and vfo readouts, the counter in Fig. 1 was designed, which was similar to one described in *Ham Radio*.[1]

Only the vfo signal is measured, which avoids the complexity of sequentially measuring the frequency of several oscillators. The signal from the vfo in the R4B, which tunes from 5445 kHz down to 4995 kHz, was mixed in a digital mixer (7474) with the output of a crystal oscillator at 5445 kHz, to produce a difference signal in the range of 0-500 kHz.

Since I wanted the ability to accurately calibrate the display, a variable capacitor was used to adjust the frequency of the crystal oscillator which fed the digital mixer, so that the counter could be adjusted to zero on each band. The output of the mixer was fed to the counting circuitry, which displayed a three-digit count (10 kHz, 1 kHz, 100 Hz) fifty times per second. A 50-Hz flicker rate in the LED display is not detectable by the eye, and eliminates the need for latches between the output of the decade counters and the seven-segment decoder-drivers.

After using this readout for over six months, I decided that the overall performance was not satisfactory. First, the three digits did not display sufficient information. I found that I was constantly referring to the receiver dial to determine in which 100-kHz band segment I was operating. Second, since the basic count interval was 10 ms, and the counter was not synchronized to the input signal, the low-order digit flickered annoyingly between two values. Finally, the frequency adjustment obtained with the simple variable crystal oscillator was not sufficient to cover the variation in hfo mixer crystals in the receiver. So, a second design was undertaken with the aim of correcting the faults which had become apparent in the existing display.

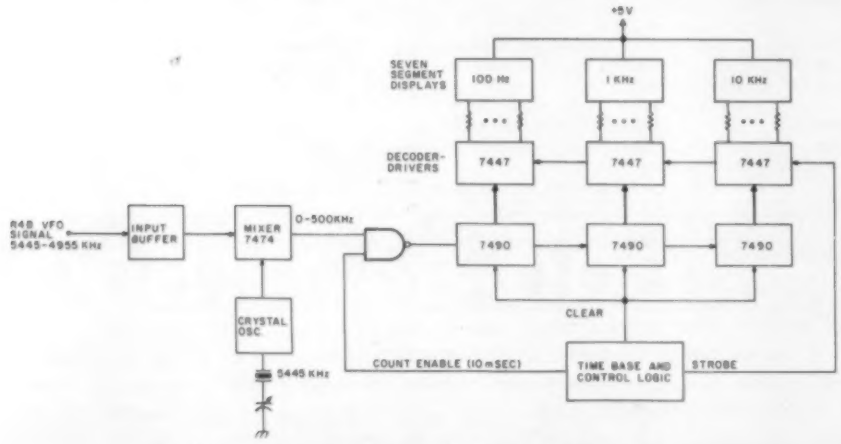

Fig. 1. Block diagram of the first digital readout.

The new version of the display corrects the problems discussed above, and can be built for less than $50 if all of the parts are purchased new. The display was designed with four digits and 100-Hz resolution, as shown in the block diagram of Fig. 2. The incoming signal is first divided by ten, and the basic count interval increased to 100 ms, to eliminate the flicker in the last digit.

After some thought, I realized that mixing the vfo signal to produce the 0-500-kHz signal represented unneeded complexity. Measurement of the vfo

signal could be done directly by simply down-counting or subtracting, rather than counting upward in the counters. To accomplish this, presettable down-counters (74192s) are used and preset to 455.0. When the signal from the vfo at 5455.0 is subtracted from this count, the correct reading of 000.0 is displayed in the lower four digits. The most significant digit is dropped. When the vfo is tuned to 4955.0, the display will show 500.0 kHz. To display readings corresponding to 500.0 to 999.9, the preset count is changed to 955.0. Circuitry for the counter and display is shown in Fig. 3.

Using the presettable down-counters also solves the problem of how to calibrate the readout. Instead of presetting the two low-order digits to fixed values, the preset values are determined by the contents of two additional decade counters (7490s). The contents of these two counters may be altered by simply pulsing their inputs until the preset is correct to calibrate the counter. The preset value in these two digits ranges from 0.0 to 9.9, corresponding to an adjustment range of −5 kHz and +4.9 kHz about the nominal frequency. This range represents a sufficient adjustment range for the crystals used in the receiver and corresponds to approximately a 0.01% or greater tolerance on the mixer crystals used in the R4B receiver. In the digital readout for the R4B, the third digit is always preset to the value 5. The fourth digit is preset to either 4 or 9, depending upon which 500-kHz segment is being used, and is selected by a front panel switch.

The vfo range and preset number are also shown in Table 1 for other rigs which were available to me. The Heath line of vfos do not have the convenient 5-kHz offset. However, switch-selectable preset can easily be added to the third digit of the counter. It should also be possible to shift the heterodyne oscillator crystals with a capacitor, in order to ensure that an offset always exists. A third alternative is to replace the oscillator crystals with new ones offset by 5 kHz.

The timebase circuitry (Fig. 4) is of straightforward design. A counter chain

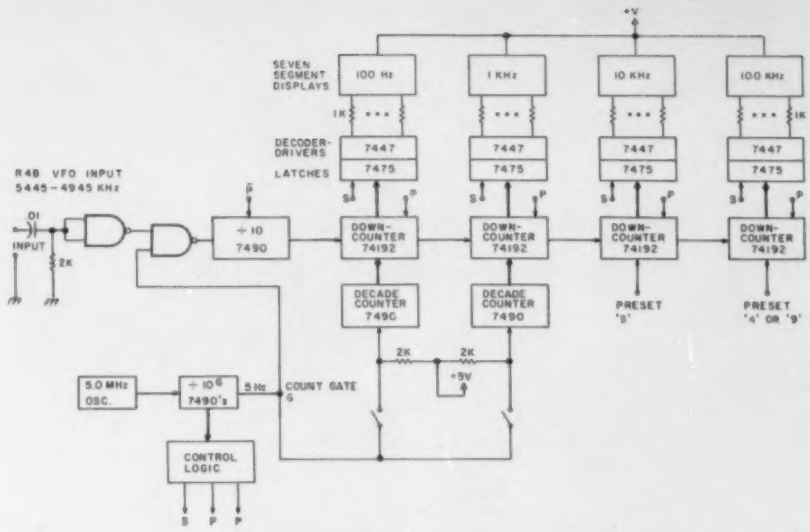

Fig. 2. Block diagram of an improved digital readout. C = count gate; S = strobe for 7475; P = preset for counters.

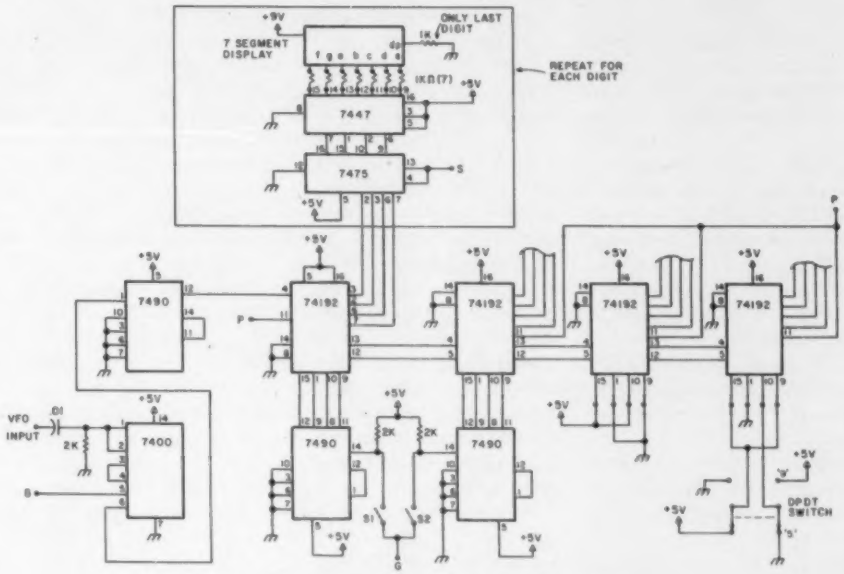

Fig. 3. Counter, display, and display drivers.

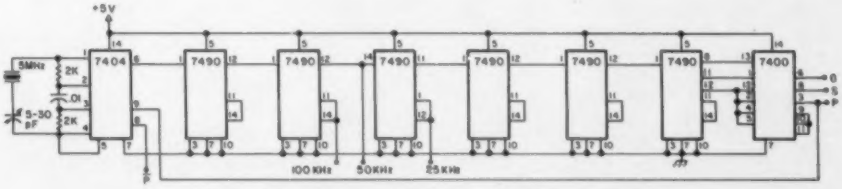

Fig. 4. Timebase and control signal generator.

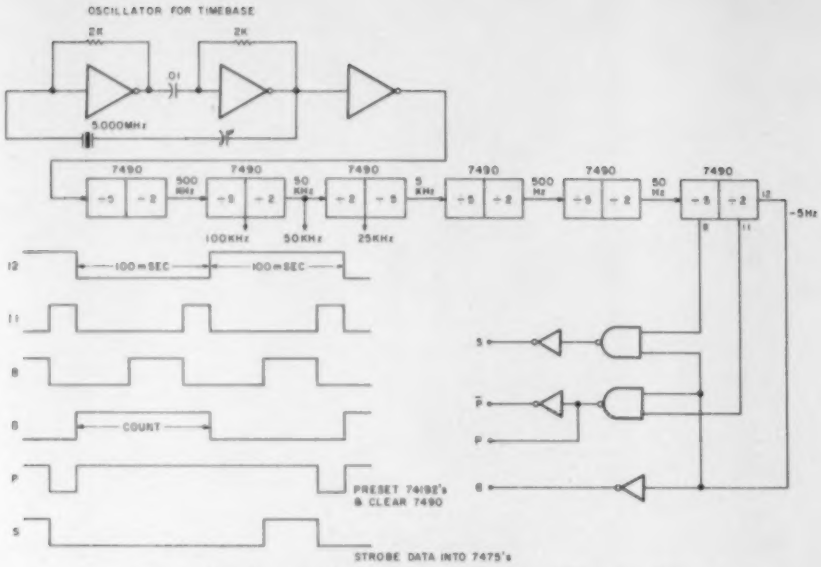

Fig. 5. Timebase and control logic for the digital readout.

divides the output of a 5-MHz oscillator down to 5 Hz. One intermediate divider stage is wired in divide-by-two, divide-by-five fashion, so that 100-kHz, 50-kHz, and 25-kHz outputs are available and may be switch-selected for calibrator purposes, if desired.

The control signals were designed to be of minimum complexity. As shown in Fig. 5, the timebase output is a signal with a 200-ms period. During one 100-ms period, the contents of the counter are gated to the display latches, and continuously displayed on the seven-segment displays. The preset values are then gated into the counters, and the counter is ready to measure the input signal. During the next 100-ms period, the counters are decremented by the input signal, and the cycle then repeats itself.

The vfo signal from the R4B is obtained at the output of the low-pass filter (C132, L6, C149) which is connected to the output of the vfo unit as shown in Fig. 6. The signal is tapped off at the junction of C149 and L6 through a .01-uF capacitor. An attachment is made to the circuit board mounted directly behind the af gain control, and the wire is routed along the side of the chassis to a phono socket installed in the spare position on the back of the R4B.

The digital readout was packaged with its power supply in a small cabinet. The power supply (Fig. 7) uses a full-wave bridge rectifier with a capacitive filter, followed by an LM309 5-volt regulator. The seven-segment displays do not require regulated voltage, and the display drivers (7447) can use a segment supply of up to 15 volts. Power for the seven-segment displays is therefore tapped off ahead of the regulator, in order to minimize dissipation in the regulator. The filter capacitors were chosen to maximize the ripple at the regulator input, while ensuring that the regulator does not drop out of regulation. This can be done easily using an oscilloscope, and also minimizes regulator dissipation. The displays are mounted in a socket assembly and bezel unit which adds immeasurably to the overall appearance of the display.

A toggle switch selects either a 0-500.0 or 500.0-999.9 display. Two push-buttons are used to calibrate the two low-order digits of the display. Calibration is accomplished by first adjusting the receiver to zero-beat with the calibrator signal. This can be done quite accurately by watching the S-meter as the receiver is adjusted to zero-beat. At zero-beat, the S-meter needle will waver back and forth at a low frequency. After the receiver is adjusted to zero-beat, the two buttons on the readout are depressed until the readout displays the correct frequency. One will get the hang of this adjustment after a little practice. The calibration obtained is well within the 100-Hz resolution of the readout, and the display accurately reads out the frequency to which the receiver is tuned to within 100 Hz. The stability of the timebase in the counter has been found to be more than adequate for this resolution. Drift of the timebase has been measured to be less than 100 Hz from a cold start.

This version of the readout has been in use now for approximately two years, and has proved to be a useful addition to the shack. The display permits an accurate QSY, allowing one to return to the exact frequency of a desired station during contests or when chasing DX. The calibration feature also allows the offset associated with CW reception (100-1000-Hz) to be removed, so that the display indicates the frequency of the received signal directly. ■

Transceiver	Vfo range	Preset	Mode
HW-101, SB-101	5500-5000	500	Down count
HW-32	1770-1620	970	Down count

Table 1.

Reference

1. Gerd H. Schrick, "Digital Readout Variable Frequency Oscillator," *Ham Radio*, January, 1973, pp. 14-19.

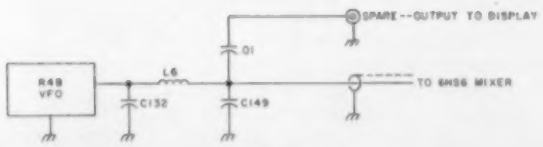

Fig. 6.

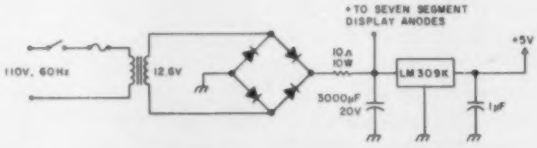

Fig. 7. Display power supply.

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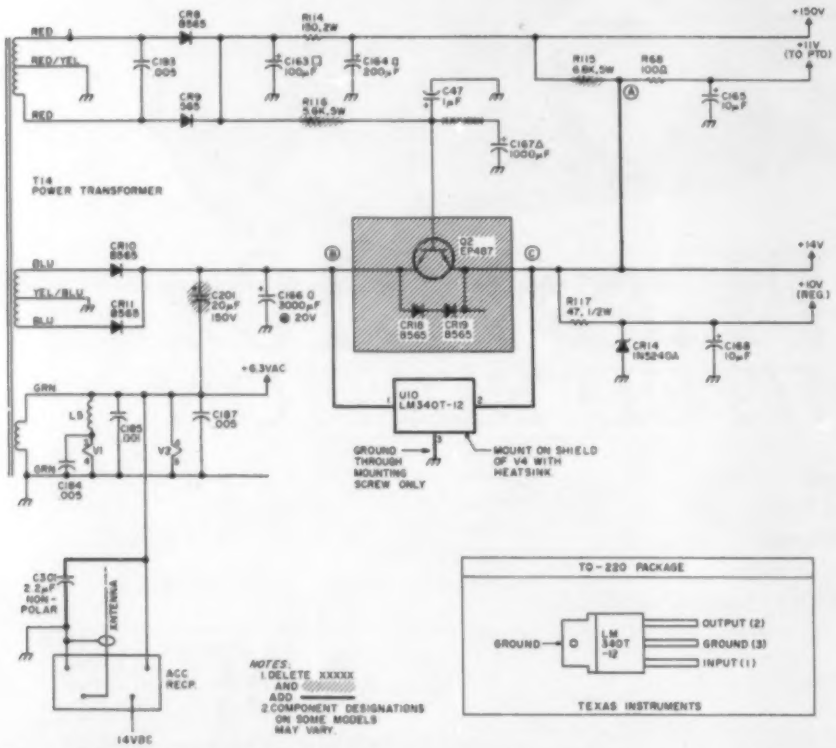

Fig. 1. A simple three-terminal integrated circuit regulator can easily be added to almost any receiver low-voltage supply to improve hum, ripple, and circuit decoupling. The example circuit is taken from the Drake R-4C.

Modern receiver equipment designs often become obsolete before they can be manufactured, tested, and sold. Unfortunately, highly-reliable printed circuit boards almost freeze the performance design of many solid-state receivers. Some of the more exotic, sophisticated technologies are difficult to add to miniaturized solid-state receivers or transceivers. Marketing policies don't make a printed circuit board substitution upgrade possible. But, within the decade, the increasing costs of receivers will make this a very profitable market either for original manufacturers or for small specialty-electronics firms. One of the really big advantages of vacuum-tube equipment is that usually the normally spacious layout permits easy maintenance as well as "graceful" upgrading in the ham shack.

Several field changes that utilize new high-performance components and circuit concepts are described in this article.

Some of them are not even standard equipment in the latest off-the-shelf solid-state receivers. For example, a high-performance, wide dynamic range, doubly-balanced modulator with all of the adjustments factory-set within the device can be added very easily to almost any receiver. The popular Drake R-4B and R-4C radio receivers are used as typical examples of how older receiver performance can be upgraded by simple field changes. Greater local oscillator suppression, better crystal filter floors, and a wide dynamic range product detector are among the easy-to-make changes that produce a big difference in performance. None of the field-change improvements takes over 45 minutes to incorporate.

Low-voltage Power Supply

A miniature, 3-terminal, integrated circuit, 12-volt regulator can replace the high-voltage (150 V dc) drop-down sources while greatly improving the hum and rectifier hash noise. The lower source impedance of an electronic regulator can improve distortion problems. A big improvement for Drake equipment is the removal of the drop-down resistors and transformer which produce 15 Watts of heat. This improvement will increase the component reliability of the receiver, and will also reduce vfo drift.

Presently, the 11 volts is obtained through a power-dropping resistor from the 150-volt line. A reference source for the 14-volt line is obtained through another power-dropping resistor from the 150 volts. A capacitance-multiplying transistor circuit smooths the 14 volts, but the ripple output is still greater than 50 millivolts on many power supplies.

The three-terminal voltage regulator reduces the ripple and hash to less than 2 millivolts.

At a cost of less than $3, the change takes only 45 minutes to make. Refer to Fig. 1. Here are the procedures:

1. Install the 3-terminal LM340T-12 voltage regulator (manufactured by either TI or National) on the third mixer, V4 (6EJ7), shield just above and on the same side as pin 9 of the tube socket. Use a small general-purpose finned heat sink mounted under the integrated circuit tab. Drill a 9/32" hole and use 6-32 hardware.

2. Remove these parts:
Q2—EP-487, regulator transistor;
CR18/19—B565, rectifiers;
C201—20 uF, electrolytic capacitor;
R115—6,800 Ohm, 5-Watt resistor;
R116—5,600 Ohm, 5-Watt resistor. Note the location of the bottom hole (chassis end) where the resistor is removed, labeled point "A" in Fig. 1; you'll need it later.
The wire to C167Δ, 1000-uF electrolytic capacitor (marked C166 on some schematics).

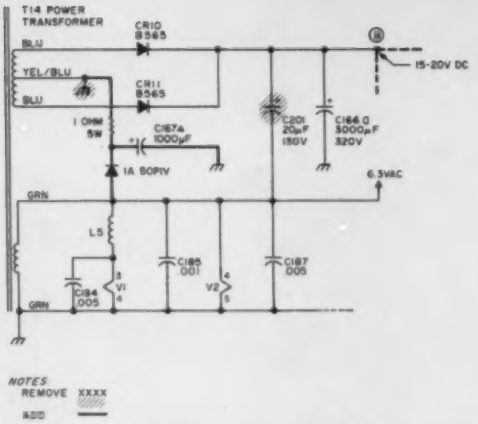

Fig. 2. If the low-voltage winding doesn't provide enough voltage to the integrated circuit voltage regulator, the 6.3 V ac filament winding can be used with a simple half-wave rectifier to boost the voltage.

Caution: Stay away from the upper holes where the power resistors were removed. Accidental connection to this 150-volt line can cause damage!

3. Wire point "B" at the dc input of the old Q2 regulator to the new regulator input, pin 1.

4. Wire point "C" at the dc output of the old Q2 regulator to the new regulator output, pin 2. (Ground is made through the integrated circuit tab.)

5. Jumper wire from the marked bottom hole of the old power resistor, R115 (6,800 Ohm), point "A" to the "+14 V" (now +12 V) bus point where all of the red wires are terminated. This step connects the 11 V line to the new +12 V line. The circuit impedance is now low enough to prevent any interaction.

6. Add a 2.2 uF non-polarized capacitor (25-volt minimum) across the filament socket as shown in Fig. 1.

7. Check the voltages listed in Table 1 after visually confirming the wiring.

If the existing low-

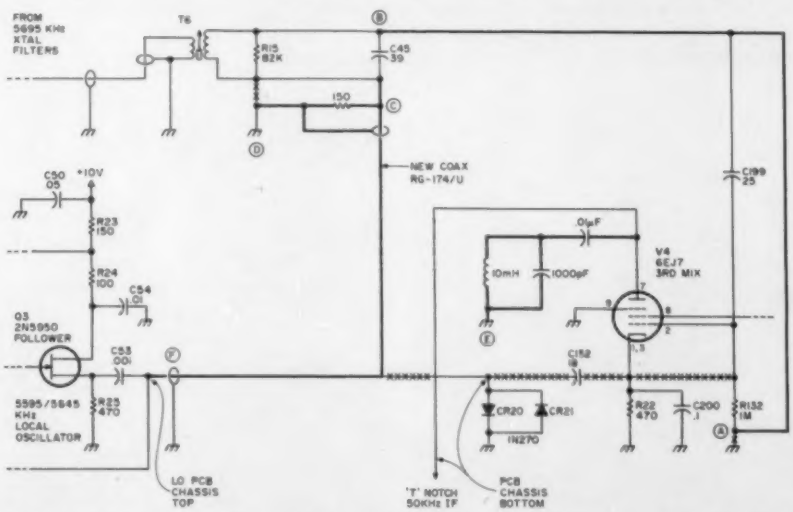

Fig. 3. Proper signal and LO feed and termination techniques are applied to the Drake R-4C receiver third mixer.

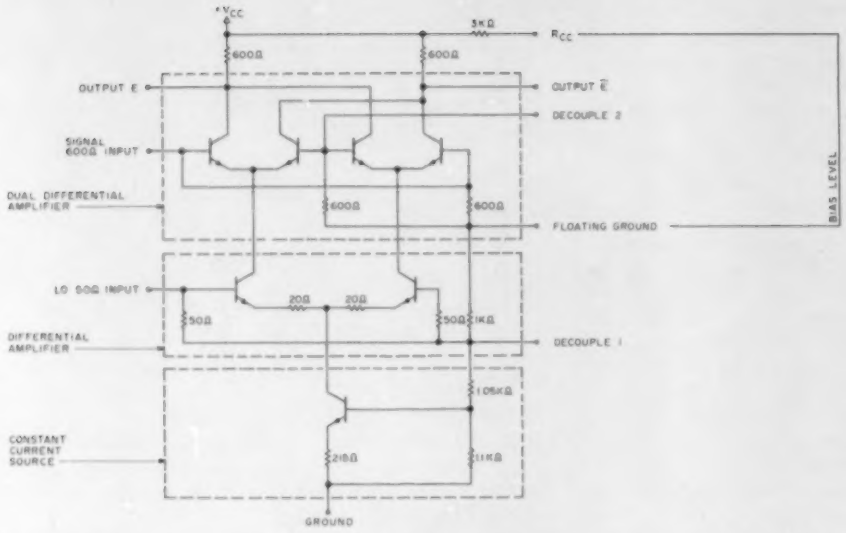

Fig. 4. Diagram of the ready-to-use TL442 doubly-balanced mixer/modulator shows the internal functions which require no external controls or additional circuitry.

voltage transformer winding doesn't provide at least 15 volts, then the 6.3 V ac section of the filament winding can be used to boost the voltage to the regulator. Fig. 2 shows how to bootstrap the 6.3 V ac filament line to the center tap of the low-voltage winding through the use of a simple half-wave rectifier. The unused C167Δ, 1000-uF filter capacitor provides sufficient filtering. The integrated circuit does the rest. If the voltage input to the regulator is too high, additional heat sinking may be required.

Mixer LO and Signal Feeding

Mixers are the first place where receiver performance falls short of our expectations. If the mixer is ahead of the filters, then third-order interference is created within the amateur bands. Specified as "dynamic range," this is probably the most stringent receiver specification. If the mixer is after the filters, then problems can still arise due to the same causes, except for one: The LO is not radiated back through the rf amplifier to the antenna to interfere with other radio services. And, if an audio filter is used for CW, then the dynamic range of the last mixer is not too important. However, when the LO is radiated back into the i-f or amplified without attenuation at the mixer output, then the probability that spurious responses in the receiver will be generated greatly increases. The same principles apply to the i-f signal driving the mixer, as far as reducing the output of this signal at the mixer output.

A modern solution available is to use doubly-balanced modulators to attenuate each signal at any input or output, with only the conversion signal appearing at the output. However, in practice, the bipolar balanced mixers I measured offer about 10-dB poorer dynamic range performance than MOSFETs and vacuum tubes under optimum circuit conditions. Then the only really strong case for a balanced mixer is where the signal or LO are so close in frequency to each other in the mixer output that a tuned circuit cannot discriminate against the amplified LO and signal input.

Balanced mixers do solve the spurious signal problem. However, many tests that I conducted with single versus dual-input circuits (such as a dual-gate MOSFET) have shown that the noise figure and dynamic range performance are about the same either way.

The primary factor in good mixer performance is a strong LO signal on the order of 250 mV for either a vacuum tube or a dual-gate MOSFET, fed either singly or with dual inputs. The dynamic range tends to be proportional to the gain of the particular device. Beyond these good design practices, an order-

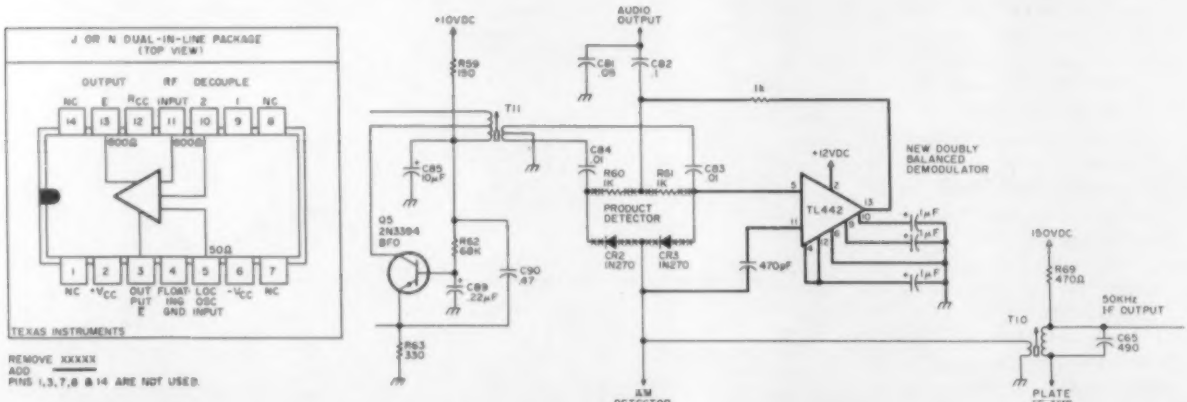

Fig. 5. A communications doubly-balanced modulator/demodulator is applied to the Drake R-4C receiver with a minimum of additional parts. No printed circuit board is needed.

of-magnitude increase in sophistication of circuitry is required.

The third mixer in the Drake R-4C was chosen to demonstrate how to apply proper feed and termination principles to a mixer. As a result, the LO and signal radiation was reduced. And, the crystal-filter rejection floor was lowered by reducing ground loop radiation. Fig. 3 shows the circuit before and after the improvements. Note that the original circuit provided a capacitive divider voltage step-up from the LO output at point "F" to the crystal-filter transformer at point "B" to enhance undesired radiation. Both the signal and the LO signals are terminated in several ground returns at the transformer, T6, grid-leak resistor R132, and limiting diodes CR20/21.

Good principles of mixer feeding were applied. First, the signal was fed with the grid-leak resistor in parallel with the coupling capacitor, thus eliminating this ground loop. Then the LO was fed in series with the signal transformer, T6. Therefore, the LO signal could not be increased, and, furthermore, the LO signal is not impressed across the secondary of the signal transformer, T6.

A 150-Ohm resistor is used to terminate and limit the LO voltage output while not enhancing harmonic generation. Finally, a tuned circuit is connected to the output of the mixer to reduce the LO and input signal by about 20 dB. As a result, the signal rejection floor of the crystal filter is reduced by more than 15 dB, and the broadband white noise is greatly reduced in the SSB mode while only slightly degrading the narrow-band CW mode of operation. Here is the procedure for incorporating this field change:

1. Disconnect the 1-megohm grid-leak resistor, R132, from ground at point "A". Bend it over and reconnect to the output terminal of the i-f transformer, T6, at point "B". It will be in parallel with the 25-pF coupling capacitor, C199.

2. Remove the 18-pF LO coupling capacitor, C52, from the printed circuit board on the bottom near the chassis to the grid at pin 2 of V4, the 6EJ7 mixer.

3. Remove the LO coax from point "F" on the LO printed circuit board on the top side of the chassis to the printed circuit board on the bottom of the chassis.

4. Separate the ground lug at point "D" from the bottom end of the i-f transformer, T6, pin by about 3/8 of an inch.

5. Connect the LO from point "F" (where the coax was just removed) with miniature coax through the same chassis hole, routing along the output (power transformer side) of the tube socket to the i-f transformer, T6. Connect the center conductor to the bottom terminal at point "C" of the transformer, T6. Connect the shield to the ground lug at point "D".

6. Install a new 150-Ohm resistor from the bottom end of the i-f transformer, T6, at point "C", to the ground lug at point "D".

7. Install the 50-kHz parallel-tuned circuit (10-mH miniature molded choke in parallel with a 1000-pF mica capacitor) in series with a 0.01-uF 500-volt disc coupling capacitor from the mixer, V4, plate, pin 7, to the ground lug (next to pin 9) below the power transformer at point "E".

8. Turn on the set after visually confirming the circuit wiring. Tune in a signal to zero beat and retune the i-f transformer, T6, for maximum signal.

Doubly-balanced Demodulator

Finally, a very high-performance communications doubly-balanced modulator is easily substituted for the dual-diode detector. The TL442 was specifically designed for communications applications by providing factory-preset null adjustments internal to the integrated circuit. Signal and LO balanced nulls are greater than 30 dB. In some of the R-4C receivers, the LO input to the first audio amplifier at the top of the volume potentiometer was about 100 millivolts compared with an audio component of just several millivolts. Fig. 4 shows a diagram of the Texas Instruments TL442 (old designation SN76514) integrated circuit. Design features:

1. factory-tuned null adjustments for both signal and local oscillator;
2. noise figure of approximately 6 dB;
3. typical conversion gain of 14 dB;
4. low standard-communication circuit input/output impedances with virtually no reactive components at HF frequencies; and
5. flat frequency response to 100 MHz, with tuning usable to 300 MHz; C_{in} = 3-5 pF and C_{out} = 10 pF.

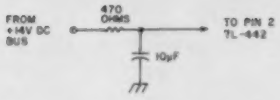

Fig. 6. Decoupling circuit required when 3-terminal regulator is not used.

UHF transistor chips are matched and the resistors are etch-trimmed in the manufacturing process to achieve balanced circuits. The IC actually consists of two cross-coupled differential amplifiers whose emitters are driven by a third differential amplifier. A constant-current source is connected to the bottom

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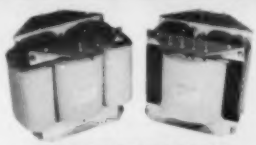

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GONSET GSB-201 Power	$135	EFJ T-BOLT Plate	$125
H-CRAFTERS HT-32 Power	$ 95	EFJ 500 Modulation	$ 95
H-CRAFTERS HT-37 Power	$ 95	EFJ 500 DC Choke	$ 75
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PLATE XFMR:	3500 VAC @ 1.0A ICAS 115/230 PRI-41LB	$150
PLATE XFMR:	4000/4600 VAC @ 1.5A ICAS 230 PRI-60LB	$195
PLATE XFMR:	6000 VCT @ 0.8A CCS 115/230 PRI-41LB	$150
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Voltage	Location	Value before	Value after
Dc input	Regulator input, pin 1	17 V dc, 300 mV ac	16 V dc, 200 mV ac
Dc output	Regulator output, pin 2 and output bus	15 V dc, 42 mV ac	12 V dc, <1 mV ac

Table 1.

(third) differential amplifier. This device works best with 200-300 mV local oscillator injection, and performs without significant overloading up to about 500 mV of i-f signal input. Hence, the signal handling characteristics of the TL442 are as good as or better than most vacuum-tube converters in current receiver designs.

For example, a two-tone test with 20-kHz separation showed that the third-order intermodulation products 20 kHz above the upper frequency signal (or 20 kHz below the lower frequency signal) were more than 75 dB below the two-tone signal level. Since the tests were conducted at 6 MHz, the performance would be expected to be somewhat better at the 50-kHz i-f frequency. Normally, the dynamic range of the audio detector is not too important as long as distortion is reasonably low, but, when audio CW filters are used, dynamic range becomes important again.

An excellent description of the TL442 is also available from Texas Instruments.[1] Cost of the doubly-balanced mixer is about $3.00, an excellent trade-off when you consider that no external tuning or bias components are required for this application.

The application of the doubly-balanced demodulator to a receiver is shown in Fig. 5. When a 3-terminal voltage regulator is not used, the decoupling circuit shown in Fig. 6 may be required. Therefore, the load on the last i-f transformer is still maintained at about 4000 Ohms and the avc action is not affected. Normal i-f input to the IC with the avc "on" is about 10 to 30 mV. The LO is connected to the 50-Ohm IC input to reduce loading on the 50-kHz local oscillator. About 125 mV are available at the IC input. The procedures for installation of the doubly-balanced demodulator are:

1. Mount the IC "dead-bug"-style (leads up with double-stick tape) on the chassis between the bfo transformer, T11, and the bfo tuning capacitor. An alternative mounting location is the back side of the bfo capacitor. Then simply wire in the leads to the printed circuit board.

2. Connect bias pins 4 and 12 together.

3. Connect pin 6 to a ground point. Then wire all three of the bypass capacitors from pins 4 and 12, 9, and 10 to the same ground point. The values of the 1.0 uF capacitors are not critical, but must bypass both audio and i-f signal components. Miniature ceramic or tantalum electrolytics with at least 10 V dc breakdown are adequate. Connect pin 2, the 12-volt input, to the 14 V dc bus line.

4. To connect the LO input, first lift the 1000-Ohm product detector resistors (R60, R61) off the printed circuit board. Then, connect a wire from one of the C84/R60 or C83/R61 junctions to the LO input of the IC at pin 5.

5. To connect the i-f input, lift the product detector diodes (CR2, CR3) off the printed circuit board at the i-f input junction point. Connect a 470-pF decoupling capacitor from this junction point to the IC i-f input, pin 11.

6. Connect output, pin 13, to the junction of old R60/R61 resistors. The result of the doubly-balanced demodulator addition is cleaner audio over a much larger signal range, particularly in the avc "off" position. Further, the frequency tuning tolerance for SSB signals is wider. Audio output is increased about 5 dB as a by-product. The low output impedance of the integrated circuit makes the audio amplifier less susceptible to hum and other spurious pickup.

12 V dc regulator
LM340T-12
Heat sink, Calectro CAT No. J4-866
Hookup wire
6/32 x 1/2 screw
6/32 lock washer
6/32 nut
2.2-uF, non-polarized capacitor
Note: for early R-4C receivers, 1 Amp 50 piv diode (not supplied)

Third mixer
10-mH choke
0.01-uF disc capacitor
1000-pF silver mica capacitor
150-Ohm resistor
12" RG-174/U coax

Doubly-balanced demodulator (product detector)
TL442
3 1.0-uF, 25 V dc tantalum capacitors
1000-Ohm resistor
470-pF disc capacitor
Hookup wire

Audio distortion correction
(thanks to R. J. Sherwood, *Ham Radio*, Dec., 1977)
0.0015-uF disc capacitor
4700-Ohm resistor

Cost: $15.00. Add 5% tax in Texas: 0.75. Shipping/handling: 0.60. Total ____. Mail check or money order to: Sartori Associates, W5DA, PO Box 2085, Richardson TX 75080.

Table 2. As many parts are hard to obtain, the author will supply parts as listed here.

Acknowledgements

Assistance and suggestions in applying and evaluating the performance of these receiver improvements are gratefully accorded to Jack Whitaker W5HEZ, Rob Sherwood WBØJGP, and the several members of the Richardson Wireless Klub. I can supply a parts kit for these changes at a cost of $15.60 postage paid. ■

References

1. Balanced Mixer Application Notes, Section 6.6 of *Linear and Interface Circuits Applications Book*, Linear Circuits Applications Dept., Mail Station 964, Texas Instruments, Inc., Dallas TX 75222.

2. *Ham Radio*, March, 1977, "Drake R-4C Modification for Improved Audio," G. R. Bailey WA3HLT.

3. *Ham Radio*, December, 1977, "Receiver Problems and Cures," R. J. Sherwood WBØJGP and G. B. Heidelman K8RRH.

4. *Ham Radio*, December, 1977, "Crystal Filter Converter," H. J. Sartori W5DA.

The audio improvement offered by reference 3 is most important. However, in many receivers, parasitic oscillations occur in the several-hundred-Hertz range, and the addition of a 0.0015 uF capacitor across resistor R83 in the audio amplifier did not entirely eliminate them. To completely correct the phase error in the feedback circuit, eliminate an undesirable peak in the audio frequency response, and eliminate the spurious oscillations, a 4700-Ohm resistor needs to be added in series with the 0.0015 uF capacitor across resistor R83.

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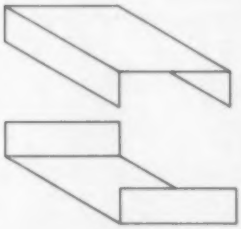

Fig. 1.

It is not too difficult to bend up your own simple cabinet with two U-shaped pieces (double clamshell rotated 90°) as shown in Fig. 1, but there is a limit to accessibility once everything is installed. If a printed circuit board is mounted above the inside of the bottom clamshell, for instance, the board must be removed or tilted away to get at the trace side. Also, unless heavy-duty bending equipment is available so that you can use quite thick material, rigidity leaves much to be desired. This article proposes a method of custom-building your own enclosure in any dimension or configuration desired. The main features are complete accessibility to the interior, excellent rigidity when the covers are removed, and reasonable cost.

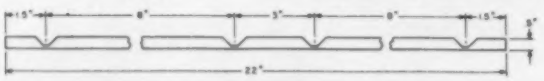

Fig. 2.

Let's Build One

To use an example: Let's build an enclosure 3" high by 6" wide and 8" deep, suitable for an electronic counter, for instance. Obtain a 5- or 6-foot length of aluminum angle material which is 1/2" on a side and 1/16" thick. This aluminum angle is generally available in hardware or building supply stores in a display containing various types of aluminum rods, straps, tubes, angles, and decorative sheets.

Fig. 3.

Cut two pieces, each 22" long. Scribe and cut four 90° notches in one side of each of the 22" lengths, as shown in Fig. 2. Use a hacksaw to cut and a file to smooth up the notches. Now, carefully bend 90° at each notch so you end up with two identical rectangular pieces like the one shown in Fig. 3. These are the side rails. You can bend this material only once, so do it right the first time. You may want to practice on some short lengths of angle before starting on the 22" lengths.

Cut two pieces of .06" aluminum sheet 3" by 6" for the front and back panels. (Or cut 3-1/16" by 6"—see *Note* in the section "Cover It Up" below). You could use .05" sheet, but .06" is surprisingly more sturdy and not that much more difficult to work with. Fasten the 3" by 6" plates to the side rails as shown in Fig. 4 and you

have a very sturdy enclosure ready for stuffing.

The leftover lengths of aluminum angle can now be used to make mounting surfaces inside the enclosure by attaching to the side rails and front and back panels. By cutting off short 1/2" lengths of the angle material, handy little mounting angles can be made to help in fastening the mounting surfaces. When fastening to the rails, use 4/40 or 4/36 flathead screws, countersunk, in order to retain the flat outer surfaces of the rails to help in fitting covers. (Handy hint! Obtain a 1/4" machinist's center drill used by metal lathe operators. It will drill a no. 4 clearance hole and countersink it in one operation. I always keep one handy on the bench, mounted in a handle, for quick deburring and countersinking.)

Larger Enclosures

Look for 3/4" by 1/16" or 1" by 1/16" angle material. Larger enclosures can be fabricated using this wider stock, and good rigidity will still be maintained. The 3/4" by 1/8" angle should also be considered if an exceptionally strong enclosure is desired. While the 1/8" angle is too thick to notch and bend as with the 1/16", suitable lengths can be cut to 45° on each end and fastened together with 90° angle plates or brackets placed inside the rails as shown in Fig. 5. I suppose, for very large enclosures, the rails could be welded up using steel angle material of suitable width and thickness.

Sloping Front Panel

By reducing the angle of one front notch and increasing the angle of the other, rails for a sloping front panel can be made. Caution! The rails will no longer be identical; you must make a right and a left rail. The dimensions and angle of notches can be determined mathematically, but it is simpler to draw out the side profile of the proposed rail and take the dimensions and angles from the drawing as shown in Fig. 6. Don't forget that now you must make the front panel larger than the back panel, to cover the longer sloped distance at the front.

Card Rack Enclosures

By using the fabricated rectangles as front and back rails instead of side rails and supporting them with side panels as in Fig. 7, an enclosure can be made with the top, bottom, front, and back accessible. By hinging the front and back panels, you have access to remove cards from the front and to service socket bus lines from the back of the enclosure. Piano hinges, which are available in different lengths, can be cut to size and are very sturdy. An enclosure for an S-100 bus system could be made up using a hinged top cover.

By now you can see the possibilities are virtually unlimited.

Cover It Up

A simple way to make a cover for the 3" x 6" x 8" enclosure described earlier would be to first make a bottom cover. Make sure this bottom plate is flush all the way around and fasten it to the rails with tapped or self-tapping screws pushed through rubber mounting feet. Or you can fasten the plate normally and use the self-stick feet that are available. *Note: If you make the front and back panels 1/16" higher than the 3" required, they can be offset down, when fastened, to cover the edges of the bottom plate when installed, to give a cleaner look.*

Bend up a clamshell to cover the top and sides as shown in Fig. 8. Don't be afraid of bending aluminum or light steel if you don't have a metal brake. A 4-foot length of 1-1/2" steel angle obtained at a junk yard, cut in half and held in a bench vise, works fine. A plastic-tipped hammer helps to sharpen the bends without denting the material. (A regular hammer and a wood block will do the same.) If you should want a semi-rounded look, the side rails can be rounded slightly with a file to soften the sharp edges. When bending wide surfaces with your homemade brake, use the vise in the middle and C-clamps at the ends to hold the angle pieces together. When making bends too deep for the vise, use an angled C-clamp at one end and the vise at the other.

If inadequate ventilation could be a problem, here is one approach. Drill holes in the bottom plate to let cool air enter. Make the clamshell cover about 1/8" or so higher than needed and fasten it up on the side rails so there is a gap between the top of the front and back panels and the cover. Warm air can escape through these gaps Make the cover 3/4" longer than the rails and overlap 1/4" at the rear and 1/2" at the front. The air gaps will not be noticed. Angle the edges of the cover at the front so it extends 1/2" at the top and is almost flush at the bottom. This gives it an attractive light-shield effect.

Concerning ventilation, if you have hesitated to drill holes in covers because you can't do it cleanly, read on. First determine the size hole and the spacing between holes which look attractive to you. Drilling out small scrap pieces of material on a trial basis might help you to decide. Carefully measure and draw out on the cover a grid of squares to locate the holes. Start from the center and work out so symmetry is retained. Use a center punch to make a

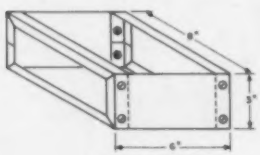

Fig. 4.

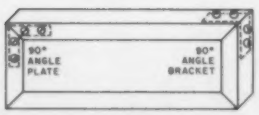

Fig. 5.

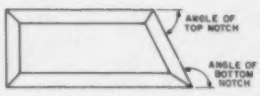

Fig. 6.

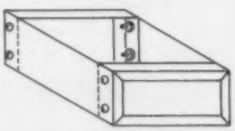
Fig. 7.

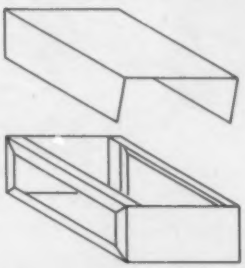
Fig. 8.

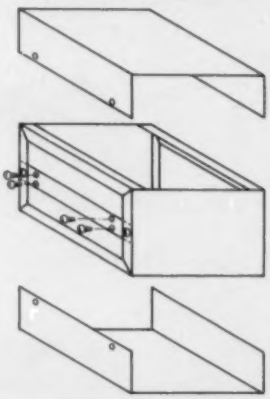
Fig. 9.

mark at the intersection of the squares of the grid. Use a small drill bit, 1/16" or so, to drill a pilot hole at each punch mark. The care with which you mark and drill the pilot holes determines the professional appearance of the end result.

Drill out the pilot holes with a drill the next size smaller than the drill you selected for the final hole size, then drill to final hole size. Keep this last drill handy. Sand down the burrs on the holes using the sturdiest sanding material you can find. The cloth-backed sanding belts from a small belt sander are perfect. Use a wood block to back up the sanding material. As the burrs are sanded down, push the drill bit through the holes to clean out the residue and sand some more. When the burrs are gone, use a finer grade of sanding material until the surface is smooth. Always use a backing block when sanding or the holes will be dished out. Keep pushing the drill through as you proceed to clean out the holes. You will end up with holes with perfectly clean edges, looking as though they were punched out.

A final word on covers: A double clamshell is a little more difficult to fit, but, as shown in Fig. 9, it may be more commercial looking. A piece of angle or strap material is fastened in the middle of the rail as shown and the two halves fastened to this when assembled. The popular bail-type handle also can be attached at the point of balance, if desired.

Dress It Up

Consider the use of a false front panel or escutcheon. When you mount the regular front plate to the side rails, use countersunk flat-head screws. If any other mountings or partitions are fastened to the front plate, countersink these also. A false-front panel will now cover up all the screw heads. This panel can be made of very thin material, painted attractively, or covered with one of the many self-stick vinyl products now available, such as wood grain. You may want to use the old trick of etching aluminum in a lye and water solution to produce a soft, satiny look. Use rub-on lettering for a professional appearance. If there are not enough switches or controls to hold the false front in place, use double sticky tape or dabs of silicone sealer (RTV).

If you are photographically inclined, you could draw up the panel, letter it, and photograph it. The lettering could be rub-on letters, carefully printed hand-lettering, or the product of a LeRoy lettering set or a Selectric typewriter. Make a print the proper size and fasten it to the false front with rubber cement. If your drawing is made on a black surface with white lettering, the print can be purposely underexposed to a medium grey and then toned to almost any color. (Ask at a photo store for toner of the color desired.) Spray lacquer applied to the print will keep it protected and looking new.

Several years ago I built my own electronic counter and used this type of enclosure. Since then I have made many changes and additions to the counter in order to keep up with the state of the art, and it has been a real pleasure to work on it. I can highly recommend that you try this method of enclosure construction for your next project. ■

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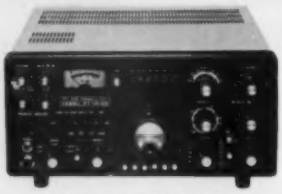

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How Do You Use ICs?

—part XI

Battery power amps.

The article on linear preamps probably left a lot of battery-power freaks with their tongues hanging out. It bothered me, too. There was a nice simple way to get the preamps to work below nine volts with good margin, but only one power amplifier would go as low as nine volts—the LM380CN mini-DIP—and it was going to be critical at that.

There had to be a way; there's too much of a gap there. A little more digging in the linear book came up with a real humdinger.

I think you are going to like the LM386. It has a rated output of about 500 mW—which may not seem like much, considering what I said about the LM380CN. It, too, is in a mini-DIP package, but there are a few things that this one does that really make a difference. To start with, the IC works over a range of 4-12 volts. That takes care of your nine-volt battery just fine, and it can't be matched at all by the LM380CN or its big brother, and more than makes up for the slight output.

Even this should not be downgraded. The IC will handle a 4- to 16-Ohm speaker or set of phones, and, with phones, that 500 mW will pierce your ears for you.

There is, of course, one little drawback; there had to be. This is the maximum supply voltage. You can't exceed 15 volts source. This is rather close to the 13.8 volts on which your car or truck is supposed to run. It is possible that a surge might exceed that much, or some trouble might result in more voltage than the device can handle. It would appear a simple design problem, however, to include a zener to limit the voltage swing or a regulator circuit to handle it. This would be needed only for mobile use or where there was some possibility of voltage surges which could cause trouble. I don't see it as a serious problem if you take basic precautions.

Fig. 1 shows the device and its pinout.[1] This looks a whole heap like all the other amplifier ICs, but there are some differences.

Fig. 2 gives the hookup, another minimal-part circuit. There were a few subtle differences noticed with this IC compared with the others. The 0.05-uF cap and the 10-Ohm resistor do the same job as with the others. They suppress a high-frequency oscillation which may come. The output cap value is not critical. The larger value passes

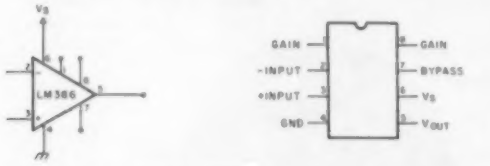

Fig. 1. LM386 low-voltage audio power amplifier.

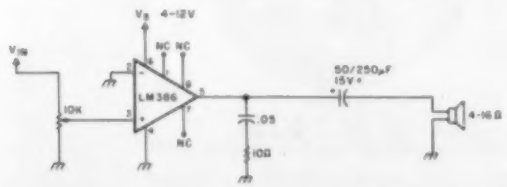

Fig. 2. Basic LM386 audio amplifier circuit.

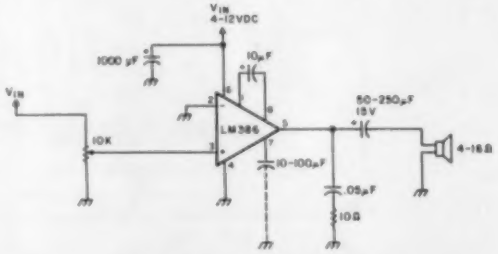

Fig. 3. LM386 high-gain circuit.

the low tones, and smaller value will cut them off, which is acceptable for communications use. The 10k volume control is not a critical value, but there should be something there, even a fixed value. With some configurations, there will be instability without an input resistor. The pin seven bypass may help in some applications, but I did not notice any gain in circuit performance with or without it.

Up to this point, we just about have a repeat of the LM380 series of amplifiers except for the voltage rating, but the LM386 has one more important trick up its sleeve. Notice that there are two pins labeled gain: pins one and eight. The circuit given here has a nominal gain of 20, which is about the same as the LM380 series. Using the gain pins can give you gain up to 200. The hookup is shown in Fig. 3. The 10-uF capacitor bypasses an internal resistor which limited the gain. With the 10 uF you get the full 200 or so gain. With a resistor in series, you can set the gain where you want it.

Fig. 4 shows that part of the circuit. The 1.2k value was shown in the application notes as giving a gain of about 50.[1] By ear, a 2200-Ohm resistor will give about the same gain as no RC network at all. The nearest variable you could use should be a 2.5k- or 5k-linear taper potentiometer. This would give you an adjustable gain option to play with. Remember that the pot gets hooked up backwards. To increase the gain, you decrease the resistance in the circuit.

Using this high-gain option has its price, too. That 1000-uF Vcc bypass is something new. I found that with this IC, a lot of supply bypassing is needed to avoid stray oscillation.

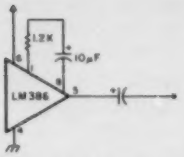

Fig. 4. 50-gain circuit.

This may be due to using the long power leads and test leads, but this is a high-gain IC. Even in the low-gain configuration, you may need this much supply bypassing as well as the input resistance.

Once the circuit is tame, the results are worth the effort; for sheer performance it is hard to beat. It combines in one package an effective audio-power amplifier with the sensitivity of the audio preamps. The circuit is simpler than the two separate stages would be and works just as well.

There was a bit too much measuring with the audio preamps, so this time let's stick to how it sounds. The power amplifier part actually sounds the same as the other power amplifiers, in its low-gain setup. It has a nice hefty output to your ear and should do any communications job easily. The sensitivity of the stage at low gain is about the same, too. This, by itself, is really quite sensitive. Using the mike, I was getting just about the same usable input to my ear as with the preamps and the high impedance phones of that test setup. When I went to the high-gain setup, things really got to be interesting. Once the circuit got tamed, it really took off in performance. That high-gain setup is *really* sensitive. I had no problem picking up background noise to my heart's content, but a nearby sound would scramble my brains. That thing is *loud*.

It has reinforced my feeling that there is little need for the separate preamp for most ham use. This one

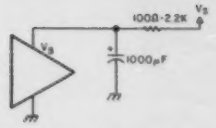

Fig. 5. Brute force bypassing for preamps or amps.

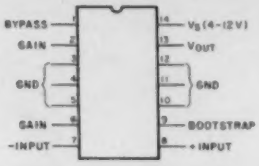

Fig. 6. LM388 1.5-Watt audio power amplifier.

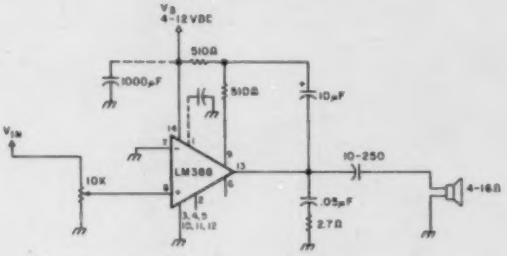

Fig. 7. LM388 basic circuit.

IC can perform the function—if needed at all—and much easier, by itself. It did bring up one serious hindsight view, however. When I did the preamp series, I used the bypass values on hand to tame the circuits. Beyond a certain point, they did not work. They were fairly low values reflecting what the application notes showed. At that time, I did not have any 1000-uF capacitors on hand. It may be that some of those high-gain stages which I found to be too unstable can be tamed with brute force bypassing.

Since the preamp current is slight, there is little chance of serious voltage drop, so you also can try adding a series resistor in the V_S lead shown in Fig. 5. A value of 1k or 2.2k might be a good starting point. This might tame some of those wilder circuits for serious use. I still don't think you will need all that gain, but if you do, it might be worth a try.

The LM386 appeared—by ear—to give the same functional sensitivity as the best of the preamp circuits given. They were in the 40-dB class. A gain of 200 is 46 dB.

There is one other IC in this family to watch for, the LM388, which is the big brother of the LM386. It is a 1.5-Watt, 14-pin IC power amplifier. (See Fig. 6.[2]) It is slightly more complicated to put together. The basic hookup is shown in Fig. 7. Notice the two 510-Ohm resistors and the 10-uF bypass. The high-frequency bypass circuit uses the values given also for the LM380—0.05 uF and 2.7 Ohms. Unfortunately, I was not able to get this IC from my dealers. I have never seen it or the LM386 listed, so you will have to write and see. The LM386 is available from James Electronics for $1.10.

Ordinarily I do not like to show a circuit without having tested it, but the power amps have worked so well that I think it is safe to do so. It gives you the basic information about it,

a) HIGH GAIN

b) VARIABLE GAIN

Fig. 8. LM388 gain control.

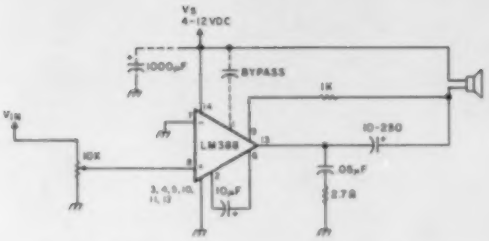

Fig. 9. LM388 load returned to V_S (gain 200).

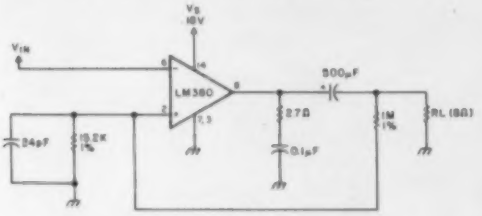

Fig. 10. LM380 high-gain circuit (not recommended!).

should they become available. The 510-Ohm resistors should be thought of as specific values in this case. They also are easily available from Jameco and other sources. The 10-uF value also is common.

This is the basic low-gain hookup—the same as the other, except for the power. I do not see a need for this for most purposes. If you are running on batteries, it means quite a bit more drain even at rest. This was a new IC, as of 1975 when my manual was printed, and there was little information included with it. I do not have the exact specs. It also has the high-gain configuration available with the addition of the capacitor between pins 2 and 6. There should be no reason why this should not be made variable as was the other. (See Fig. 8.)

There was one other circuit shown which was different from most presented. This was a high-gain circuit, but the load was returned to the V_S pin. (See Fig. 9.) I can't think of any reason why this should be a particularly desirable feature. It looks as if it might be possible for dc current to flow through the speaker winding, which might not be good for it. The manual did not say why this feature was included. My feeling would be to stay away from this circuit unless you know why you wanted it.

These ICs seem to be two-up on the LM380 series of amplifiers. They are low voltage and can be made higher gain. There is a way shown to turn the LM380 into a high-gain circuit. The specs say that, in theory, you can have gain up to 300, but they say this is hard to do and still keep it stable. The basic hookup is in Fig. 10.[3] Notice some extra parts in the basic LM380 circuit. The tip-off should be obvious. Those are one-percent resistors. I don't like one-percent resistors. Fortunately, I did not have any to try. I used a pair of resistance substitution boxes and clicked away. Very quickly, the circuit's capability showed up. For experimental use or breadboarding, it looks like a real bummer.

Without the extras, it is quite sensitive, but with them, the hum gets worse. I would assume it is the test leads. Even not counting the hum, however, the circuit didn't add anything. There was no noticeable increase in usable gain when tried with the mike input hookup. In fact, the sensitivity seemed to go down, and that's not counting the times it went into oscillation or just cut off. Even the addition of the big bypass capacitor did nothing to help.

Another bad feature of this circuit is that as you apply positive feedback to try to boost the gain, you also draw more current with the IC. This is not the healthiest thing for an IC to do. I don't think I permanently damaged any, but I wouldn't bet on it since some of them got hot to the touch. It is supposed to have built-in thermal shutdown, but why go asking for troubles like that? Stay away from this one.

I don't know why the circuit did not appear to work with any range of values tried, but that should be an indication that it is not suited to the reliable breadboard category that this series is based upon. Still, we have added one more reliable IC to the bag of solid-state tricks that are available: the LM386. It has its own strengths and weaknesses, but the battery-power option and the extra sensitivity if you need it make it a strong choice when you are planning a circuit.

Among all the linear ICs given so far, you should have something that will fit the requirements for almost any of the common audio amplifier uses. The tested circuits may not be the optimum achievable, but they should cut down on the amount of cut-and-try needed to get something that works for you. ■

References

1. *Linear Integrated Circuits*, National, February, 1975, pp. 5-51 to 5-54.
2. *Ibid.*, p. 8-2.
3. *Linear Applications*, Volume I, Radio Shack, February, 1973, Sec. AN69-7.

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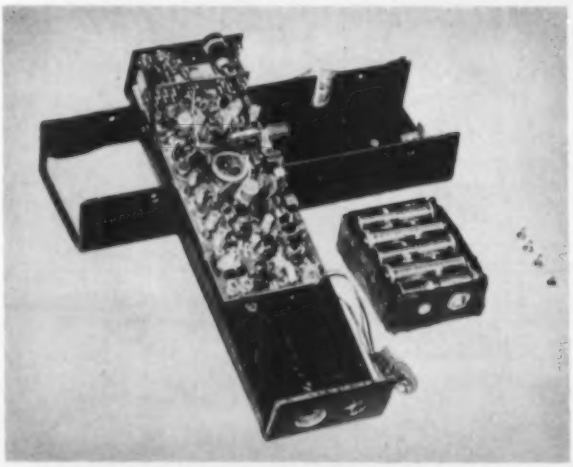
Many hams have built the VHF Engineering 2 meter HT144B kit, which has proven itself an excellent handie-talkie. Here are modifications that will make it easier to service and use, therefore enlarging your total enjoyment of 2m FM. Described will be how to:

1. Modify for simplicity of crystal changing and repairs.
2. Add a "drop-in" battery charging facility.
3. Provide for an external microphone and earphone.



The HT144B open for inspection.

4. Replace the antenna with a rubber ducky.
5. Add a touchtone™ pad.

Difficulty in changing crystals is probably the only drawback of an otherwise well-designed handie-talkie, so I will start with that modification. First, disassemble your unit, removing the antenna, the printed circuit chassis, and the four standoff spacers, disconnecting any impeding wires as you go. File down the sides of two of the spacers, as shown in Fig. 1. Mount these two spacers, orienting the filed surface outward, directly to the PC board's top two holes, using lock washers and some nail polish as cement to hold the spacer securely. Mount the remaining spacers in the other two holes of the chassis in the same manner. Now, future removal of the chassis to change the crystals will only require removing the screws from the front of the case and sliding the chassis back, eliminating the twisting, clumsy maneuver previously required due to the interference of the threaded studs mounted on the side flange of the case front. Do not reassemble the unit as yet.

Now let's get to the "drop-in" battery charging feature. First, determine if you have at least a 3/16-inch space between the bottom inside of the HT and your battery pack. If not, then obtain a battery carrier that will allow you the space. Disassemble those parts of your unit still remaining that would interfere with unobstruct-

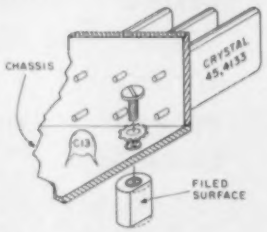


Fig. 1. How mounting studs are filed and oriented.

ed drilling of the case. Drill or punch out two ¼-inch holes as shown in Fig. 2. Next, fashion a piece of 1/16-inch-thick insulating material to fit the entire bottom inside of the case. Place it in the bottom and scribe thereon the location and outline of the holes you just made. Drill a 3/8-inch hole in the center of each scribed area. Secure this piece in place with cement or thin double-faced adhesive.

Next, we modify the battery holder. For this, you can etch a piece of one-sided copperclad PC board in the pattern and dimensions of Fig. 3 or cut out the design from thin copper sheeting.

Now, lightly "flow-tin" some solder onto the copper to provide better corrosion resistance (silver plating would be nice, if you have the facility). Affix the PC board or strips to the battery holder with cement or double-faced adhesive (to the side nearest to the snap connectors). Solder wire leads from the strips to the connectors, using care not to defeat the snap action and, more so, not to melt the plastic of the battery holder. Since this plastic melts easily, a dish of cold water for dunking immediately after soldering is a helpful precaution.

You should now have a snug-fitting battery pack when the HT is reassembled. If not, a simple cardboard shim between the battery pack and the circuit board is called for. Looking at the bottom of the HT, you should be able to see the contact strip material through the holes on the insulating board, which will be insulating them from the case by a circular area at least 1/8 of an inch wide. Paint the positive contact insulated area with red nail polish for identification.

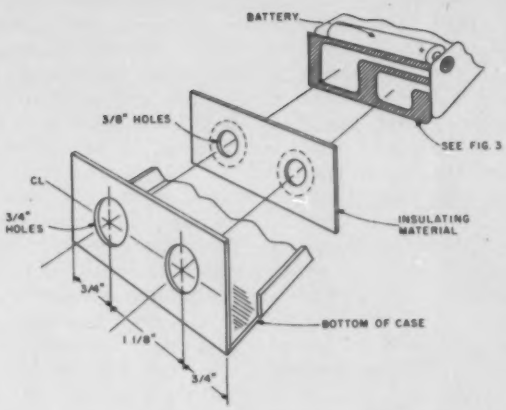


Fig. 2. "Drop-in" battery charging assembly detail.

Since it will no longer be needed, the charging socket at the top of the HT is removed and the holes used for the external mike and earphone jacks and, as a bonus, for a small LED to indicate a power-"on" condition (see Fig. 4 for layout). The LED is especially valuable, as the switch on the volume control can easily come on without enough audio being present to warn you that the battery is draining. The LED drain is minimal. Solder a "U"-shaped piece of solid #22 wire to the cathode of the LED and a 330-Ohm resistor to the anode (see Fig. 4 for configuration). Solder the other end of the "U"-shaped wire to the metal frame of the channel switch in a position that will allow the LED to slide easily into the hole left by the battery charging jack holding screw. Now, route the resistor up over and down toward the on/off switch and solder it to the proper contact so that, when the switch goes on, the LED will light.

At this point, install the microphone and earphone jacks, using closed-circuit types. Use a miniature phone jack for the microphone and a subminiature one for the earphone. Use shielded wire for the connections, as shown in Fig. 5. Wiring it in the manner shown will enable you to use the internal speaker-mike as usual, but have the convenience of using an external microphone-earphone assembly if you wish (see photo).

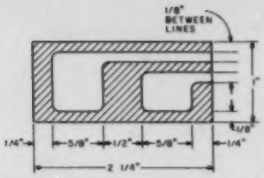


Fig. 3. Battery charging contact strip.

The Rubber Ducky

The installation of the rubber ducky is simplicity itself. Most easily obtainable and priced right is the Radio Shack #20-178 VHF. If you opt for this antenna, you can use either a subminiature phone jack or an old-fashioned pin jack. Be sure that the center contact of the jack is insulated from the case. Use shoulder washers if necessary.

Now, dig into your junk box for an old 7- or 9-pin tube socket and cannibalize it for one of the pins. It should be one that will serve as a single-pin socket for a number 16 or 18 solid, tinned copper wire. This pin is then soldered to the proper contact of the antenna jack. A 2-inch length of the solid wire mentioned above is now inserted into the pin. Slide a piece of insulating tubing about 1¼ inches long over the wire. The wire is routed straight down to the push-to-talk switch and then at right angles to the switch's

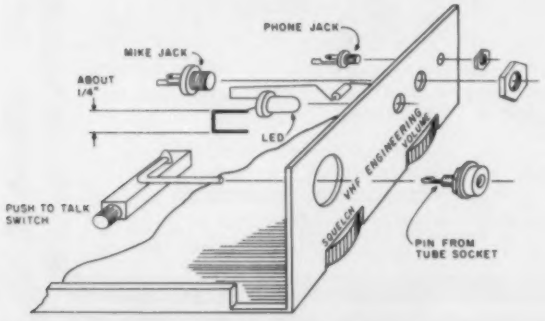


Fig. 4. Antenna and microphone plus speaker jack assembly detail.

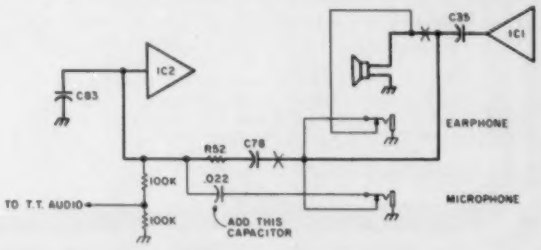


Fig. 5. Original circuit of HT 144B is in heavy lines; the modification is in light lines.

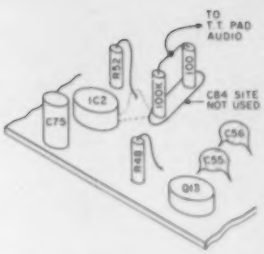


Fig. 6. Touchtone connection point showing resistor network positioning in C84 position.

antenna change-over contact. Solder it to the contact. This lead dress is important to prevent feedback. You now can avoid the chore of unsoldering the antenna connection every time the chassis is removed for crystal changes or repairs. See Fig. 4 for details.

The Touchtone Connection

By using one of the slim touchtone pads, such as one made by Barber Corp., the pad can be mounted on the outside of the HT without really adding to the bulk. If you cement the pad to the HT, you then need only one hole for the wires. Alternately, you can bolt it to the HT using small screws, but be careful that they do not intrude upon the space available for the battery carrier. The audio from the pad will need to be attenuated by a resistor network of 100 and 100k Ohms. There is a tailor-made place for the network on the chassis in the place left vacant by the unused capacitor, C84 (see Figs. 5 and 6 for circuit and layout).

Final Touches

Before buttoning up your HT, make the hole used for the push-to-talk button into a slot by cutting away the material between the hole and the edge. A nibbler does this more neatly than a hacksaw. In either case, smooth the edges, round them off slightly, and touch up the bright aluminum with flat black paint. You will now be able to remove the cover of the HT without needing to remove the push-button, which often becomes loose from frequent removals (see Fig. 4).

As a final touch and to give a nicer feel to the HT, I applied an imitation leather material to the back of it. I did not slot the push-to-talk button hole in the material, but punched out the hole and cut a slit from the edge to the hole. The stiffness of most materials will yield enough to permit passage of the button on removal or installation and yet maintain a closure at other times to give a neat appearance.

With the foregoing features installed on my HT, I use it in comfort every evening on the commuter train by holding the HT on the windowsill. With the external Plantronics headset which requires very low voice levels, there is no disturbance to fellow passengers, but it does generate a great deal of interest among them. During the several transit delays due to weather, fire, and accidents, it was comforting and useful to have the HT to advise the XYL of my homeward progress or lack of it. Autopatch or the good offices of fellow hams on the repeaters in the area provided the link. In fact, the XYL monitors the repeater for the 20 minutes prior to our usual arrival time, and, by dropping the right cue words in our QSOs, such as "This is W2KGV mobile 2 on the ConRail at White Plains station," she knows when to leave for my station to pick me up. Very convenient. ■

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When it comes to troubleshooting digital IC projects, a logic probe is indispensable, and, with so many construction projects employing digital technology, almost anyone can use one. Most commercial probes represent two problems in the eyes of hams and hobbyists: Commercial probes cost from $25 upward; and a given probe generally works with only one type of logic (TTL or CMOS). This article describes a design for a logic probe which meets all requirements for troubleshooting digital circuits, and solves the two problems mentioned.

The circuit shown in the schematic (Fig. 1) is fairly simple. The gates are CMOS, which has several advantages in this application:

1. CMOS gates have a very high input impedance and will not load the circuit being observed.

2. CMOS may be powered from 3 through 15 volts, so that the probe may be used in both CMOS and TTL circuits.

3. The supply current for CMOS ICs is extremely small, so the probe may be powered parasitically from the circuit under test—even from low-powered battery circuits.

4. CMOS gates are easily made into "one-shots" (which lengthen out pulses to make them visible).

5. CMOS has self-limiting current sourcing and sinking, which allows LEDs to be driven without the use of series resistors.

The circuit is built using five inverters, a NOR gate, a resistor, three capacitors, and three LEDs. This configuration brings another advantage. Motorola has

This is a closer view of the probe showing the method of using the IC as the component base. The capacitor lead is used for the probe tip.

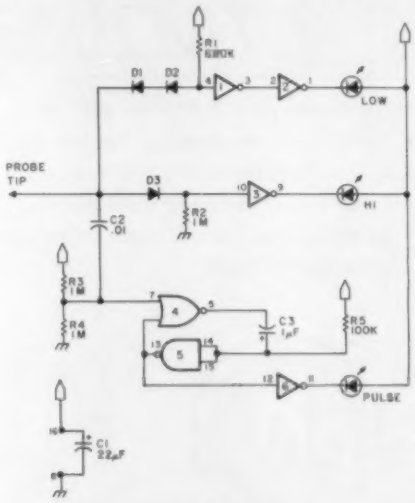


Fig. 1. Single IC logic probe.

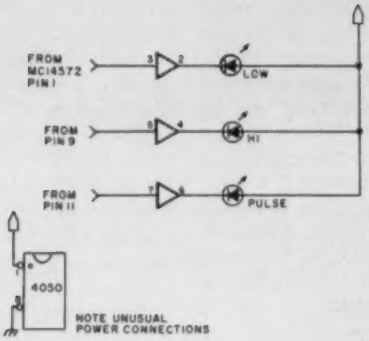


Fig. 2. Using a 4050 for extra drive.

produced a CMOS package, appropriately called a HEX gate, which contains 4 inverters, a NAND gate, and a NOR gate, which sells for about 50¢.[1]

Operation

The operation of the circuit is as simple as the circuit itself. If the probe tip is touched to an active high (or "1") signal, inverter 3 turns on the high LED, while inverters 1 and 2 keep the low LED off. When a low (logical "0") is identified by the probe tip, inverters 1 and 2 cause the low LED to turn on, and inverter 3 keeps the high LED off. The two inverters on the low line are there for buffering purposes.

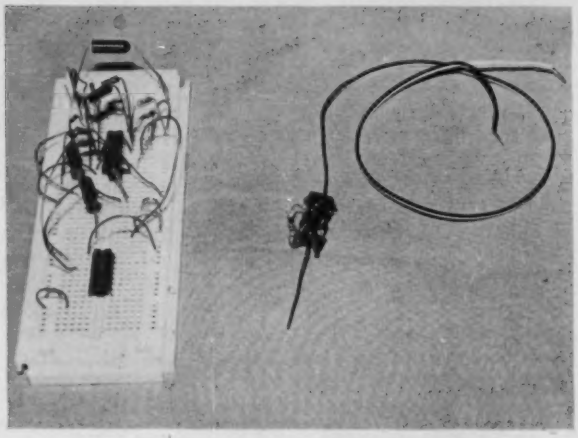
When idle, the 1 meg resistors split the supply voltage, letting R5 pull the output to a high state. This charges up the capacitor, C3, which then applies a high to the NAND (being used as an inverter), which holds the inputs to the NOR and inverter 6 low. When a negative edge of a pulse occurs, it is slowed up by the R1-C2 time constant (since the capacitor voltage cannot change instantaneously). This lengthened pulse changes the NOR output to high. Again, the pulse is lengthened by the time constant of C3 and the pull-up resistor, R5. The input to the NAND slowly changes (compared to the input pulse!) from high to low. The gate characteristics cause more of a "snap-action" than the rise and fall of the capacitor voltage. This is further squared off by inverter 6. The high signal is fed back to the NOR, which brings the output low again. (This is the "one-shot" effect.) When inverter 6 receives the lengthened pulse, it illuminates the pulse LED for the duration of the pulse.

CMOS can exhibit some memory action when the input is removed from a signal source and left floating. The diodes and pull-up and pull-down resistors eliminate this memory problem to ensure normal operation of the probe. The resistor values are fairly critical. With the values shown, the probe operates well from 0-9 volts. At more than 9 volts, some leakage current will cause the high LED to light dimly. This is easily distinguishable from a true high, however, and it will go out on a low.

Construction

If it is desired, a printed circuit board can be made. However, the author and several other builders found it easier to trim leads short and either solder or wire-wrap directly to the IC. This provides an extremely compact circuit.

The probe, when built as described above, can be mounted in about anything that is convenient.



Here are two different prototypes. All the components in the left-hand version are in the right-hand version, except for the 4050 at the bottom of the protoboard. Also, smaller LEDs were used.

My model was mounted in the casing of a Bic 4-color pen. This provides extreme portability, with the pocket clip allowing the probe to be carried around.

If desired, the LED outputs could be used to produce high and low tones, using 555s for an audio logic probe.

I have two final construction notes. The 22-uF

This is the final assembled version. A Bic 4-color pen was used as the case. The LEDs and power leads can be seen at the top, and the tip is probing an IC at the bottom. Practically anything can be used as a case, such as a cigar tube or cylindrical plastic mailing tube. You could even leave it in the "rodent" form!

Parts List

IC 1	Motorola MC 14572 CMOS integrated circuit
D1-D3	Small signal diodes, 1N914 or similar
R1	680k, ¼-Watt
R2-R4	1 meg ¼-Watt
R5	100k ¼-Watt
C1	2.2 uF tantalum (see text)
C2	.01 uF ceramic disc
C3	1 uF tantalum
LED1-LED3	miniature LEDs—color reader's choice

Optional

IC 2	4050 CMOS hex buffer (non-inverting)

tantalum capacitor between Vcc and ground is to provide additional filtering. This value is not too critical, and the circuit may work on a good power supply without it. Also, while the LEDs are not too bright, they are sufficiently bright for normal work. For a few cents more and an additional IC package, a 4050 CMOS hex buffer can be used, if desired, to provide added drive, as shown in Fig. 2. For ultra-simplicity and small size, however, the single IC version is recommended.

Conclusion

While a logic probe may be the most useful tool in a ham shack, commercial models can be fairly expensive. This probe can be built even on a poor man's budget, and, for anyone working with digital circuitry, a cheap logic probe is practically a must. ■

Reference

1. The MC 14572 is available from Graham Electronics, 133 S. Pennsylvania St., Indianapolis St., Indianapolis IN 46204, and from other Motorola distributors.

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"The Voice of Wolf Creek"

—the KGCX story

How to operate a radio station without a license.

Dr. William C. Hess W6CK
PO Box 19M
Pasadena CA 91102

Beginning in 1924, the late Joe Jacobs 7TF operated an unlicensed broadcasting station on his ranch in the wilds of Montana. In late 1925, this station was moved to the tiny village of Vida, Montana, where its illegal operation was continued by the local banker, E. E. Krebsbach. The following transcript of a 1930 speech given by Krebsbach to the Lions Club of nearby Wolf Point, was recently presented by the Krebsbach family to their long-time friend, Dr. Hess, because of his abiding interest in the history of KGCX. It details the trials and tribulations involved in operating this clandestine radio station until it was licensed and the services of a licensed operator were secured.—Ed.

Five years ago, in 1925, when I returned to Wolf Point after undergoing surgery at the Mayo Clinic, some of the local radio enthusiasts told me of hearing "The Voice of Cow Creek" on their radios. Of course, I knew at once that it must be the work of Joe Jacobs, eastern Montana's radio wizard. And it was.

At that time, Joe had a license only for operating an *amateur* station, but he was going on the air with musical programs on a wavelength of over 200 meters, which was strictly forbidden by the Department of Commerce.

Being interested in seeing a real broadcasting station which could transmit voices and music, I went down to the Jacobs Ranch as soon as the condition of the roads permitted. Joe had the transmitter sitting on a small table, and while it was not the neatest piece of construction I have ever seen, it did the work that any transmitter is capable of doing, and it did mighty well, as you all remember.

Instead of using high-priced meters such as we are using now, which cost anywhere from twelve to twenty-five dollars each, he was using old discarded seventy-five cent voltmeters. The panel was only two-feet square.

He had a hand-held microphone which had to be carried around the room to pick up organ music, phonograph, or whatever type of music they could get at their ranch home. The microphone had to be held up to the organ frame so the vibrations could be picked up; the same was the case with the phonograph music. The mike had to be attached to the phonograph cabinet, otherwise the volume of pickup would not be sufficient for broadcasts.

We all got a great deal of pleasure out of it, and I suggested that I bring the Vida Syncopators Orchestra down to the ranch and broadcast our music. Mr. Jacobs suggested that the set be taken to Vida instead, as we had more room there to broadcast from the Community Hall.

So, it was not long before Vida had a direct connection with the outside world—a pure and simple bootleg, wildcatting radio station. We operated Sunday afternoons only, and from the number of letters we received, we had a great many listeners to the foolishness we put out. I believe that at first we tried to make ourselves as foolish as possible.

In a very short time, Mr. Jacobs perfected what is known as the electrical phonograph pickup. Whether it was an innovation on his part, I don't know (he used a headphone to make it), but I do know that it was the very first time phonograph music was broadcast in the entire middlewest by the now-common electrical pickup process. Other stations at that time were broadcasting phonograph music by the now entirely obsolete system of merely placing the microphone in front of their phonographs. With that system, the quality, of course, was not nearly as good as with the electrical pickup process. It was at least a year before other stations started using our

system. This is one thing in the broadcasting game in which we were absolutely the pioneers.

We became so interested in the novelty of broadcasting that we applied to the Department of Commerce for a broadcast license for Vida—a town of twenty-five inhabitants. Of course, we assumed they would forget to look up the population of the fair city. We received a reply stating that a ban had been placed on all further radio station construction, and that the number of radio stations was to be reduced, not increased.

Still, we kept on broadcasting, not knowing the penalty. The penalty for operating a radio station without a license was $500 and six months in the coop. We did not know this, but *did* know that the practice was not exactly according to Hoyle.

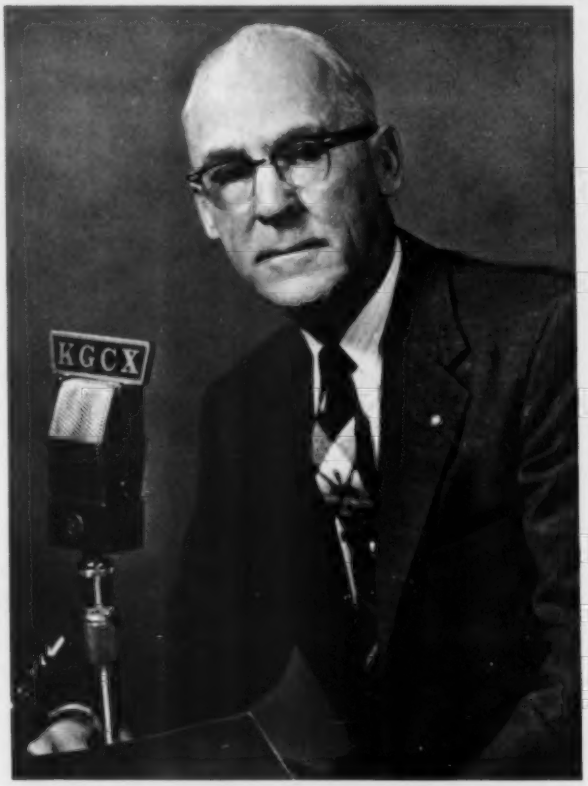
This shows Mr. Krebsbach operating the original KGCX transmitter at Vida, Montana, in 1926. Note the crank of a hand-wound phonograph at the left edge of the picture.

We started reaching out quite a distance with our broadcasts, and, finally, a bit too far, as we were heard at Froid, Montana. A certain gentleman there (this is not the term we applied to him at that time), who did not approve of Vida having a radio station when Froid could not have one, immediately sent in a complaint to the radio inspector at Seattle stating that an illegal broadcasting station was operating at Vida under the name of "The Voice of Wolf Creek."

We had changed the title of the station to this appelation when we moved it to Vida, since Vida was near Wolf Creek. Naturally, the radio inspector knew who to write to at Vida since we had submitted our application for a broadcast station to him. We knew that the applicant for a station had to be a reliable person or firm, so we had used the name of the bank where I was the cashier. So, the inspector wrote a letter at once to the First State Bank at Vida, asking the name of the owner and operator of the station at Vida—not licensed by the government—so that he could commence prosecution at once.

All was not so good around Vida (especially in the bank) for a week or two! Paul (my brother) would come in every now and then, saying, "I told you so" and "now don't get me into it"—all nice, cheery remarks, you know. The final outcome was that Mr. Jacobs lost his amateur license, and nothing further was done.

I asked a number of my friends in the surrounding towns to write to the inspector telling him that Joe was brokenhearted and felt terrible over the abrupt ending of his chosen career. About two weeks later, Joe received a letter from the Department of Commerce asking whether he wished to be reinstated



This is a picture of Mr. Krebsbach in the 1950s, at the KGCX microphone.

—and Joe was soon restored to the status of being a full-fledged amateur operator, *but* he refused to have any further connection with the bootleg radio station.

Naturally, we thought that that was the end of our broadcasting career, as we surely now had a black mark with the Department of Commerce about a foot wide. In the meantime, I got in touch with Mr. Willson of the Fobes Radio Supply, at Butte. Mr. Willson happened to be a close friend of Mr. Redfern, who was the supervisor of this 7th Radio District. I don't know what Mr. Willson did, but I do know that he was instrumental in getting our first license with the call letters KGCX. We started unlicensed broadcasting at Vida on October 1, 1925, and received our license at Vida on October 6, 1926.

At first, we started on a one-day schedule per week, broadcasting only on Sunday afternoons, as we had done without a license. However, now that we were a legitimate station, we increased the broadcasting schedule to Monday, Wednesday, and Saturday during the noon hour, and very shortly went on a daily schedule from 12:15 to 1:15 pm.

To show you how much nerve we had (that is not the exact word, but will do), we did not have a resident licensed operator as required by the government. Since we badly needed someone with a First Class radio operator's license, we decided to go to Butte on the day the assistant radio inspector was scheduled to be there giving radio examinations, so that Joe could take the First Class operator's exam.

On the designated morning, we walked over from our hotel to the Post Office building where the examination was to be held. Joe sat down, waiting for the test to start, and I went back to our hotel, about as nervous as I have been here with this station at times. I phoned Mr. Willson and told him Joe had started the examination. "Well," he said, "if he is not back at the hotel in an hour, he will have passed his code test, and then everything will be hotsy totsy."

I sat in the lobby of the hotel with my back to the door and watched the clock. For the first fifteen minutes, I was slightly nervous, and before the hour had expired, I was a nervous wreck. Each time the door to the lobby opened, I would think it was Joe coming back. The hour passed and Joe did not come; another hour passed and finally it was lunch time. I asked Mr. Willson to lunch, and we both went up to see Joe. He said he had failed the first two code tests, but that Mr. Clark, the examiner, was very nice to him and allowed him a third try at the code test, which he passed.

I thought that that was all there was to it, as surely Joe could not fail the technical part of the examination. In those examinations, you are required to know the construction of a ship transmitter, a land transmitter, and the construction and maintenance of storage batteries. You must be able to draw a complete diagram of a transmitter, and you must know ten of the radio laws. You must know what the source of the trouble is when a milliammeter, voltmeter, radio-frequency ammeter, or other meters fail to respond. And this is about half of the work in the examination, which ordinarily takes a full day to complete.

Joe finished his examination at 3 o'clock, and we went to a movie to relieve the strain. We were both happy, to say the least. We had finally conquered!

We stopped at a nearby drugstore, and phoned the radio inspector and asked for results. Joe had *flunked* by a mere three points. It was just a small matter of forgetting to connect the motor generator to the transmitter, in the diagram which Joe had drawn.

Right there and then, all of the joy went out of our lives completely. We were homesick, sick at heart, and what not. We went back to our hotel room, and Joe paced the floor on one side of the room and I on the other side. We phoned Mr. Willson and he asked us to come down to his office, which we did, and he asked us out to his home for dinner. On the way out, I remarked with a good-sized lump in my throat, "Well, that's the end of KGCX."

Mr. Willson said, "Why?"

"Well," I said, "I can't operate the station any longer without a licensed operator and risk being caught—I'll be fined $500 and spend six months in the hoosegow."

He said the $500 fine and six months in jail did not apply to operating a station without having a licensed operator, but rather to operating a station without a license.

He also said that the penalty for operating without a licensed operator was merely revocation of the station license, and that if you quit broadcasting now, you will have to surrender your KGCX station license, and then you will be through as far as getting another station license at Vida is concerned.

He further said that if you continue broadcasting without a licensed operator and get caught, the worst that can happen is that your station license will be revoked, and even if that happens you won't be any worse off than if you quit now.

He continued, "but if you continue broadcasting, Joe can take the operator's examination again in three months and will surely pass then."

Right at this point is where Wolf Point nearly never would have had a broadcasting station as, if we had followed our dictates and stopped broadcasting then at Vida, Wolf Point would not have a radio station today. The much-coveted license would have been gone forever.

We returned to Wolf Point, and it was pitiful to see Joe so nervous and disappointed over his failure. I should say at this point, that there is absolutely no disgrace in one's inability to pass the First Class operator's examination on the first attempt. I know that I would not attempt to take it at this time.

We continued to operate the Vida station, and everything went smoothly until the following June when we received word on a Friday evening that the radio inspector would arrive at Wolf Point on the following Monday morning to inspect KGCX at Vida.

The first thing to do was to hotfoot it to Wolf Point and get in touch with Mr. Johnson, at Havre, who was the holder of a First Class operator's license. He agreed to come to Wolf Point on the Sunday morning train, but he did not show up. I wired him, and he phoned back advising that he had missed the train, but that he would come on Number 4, that evening, for sure.

He did, and we spent all night rehearsing the manner of operation of our transmitter, its construction, our broadcasting schedules, etc., so that he would be fully informed and be able to deceive the radio inspector into think-

ing that he, Johnson, was actually the licensed operator of KGCX. Actually, Johnson had only been at Vida on one other occasion, when he visited there briefly just to satisfy his curiosity about our transmitter. As you know, there was only one other radio station in the whole state of Montana at that time, besides ours.

Next morning, Mr. Clark, the assistant radio inspector, was to arrive from Seattle. I had arranged that Mr. Johnson would be taken to Vida that morning on the first ferry crossing over the Missouri River. I had also arranged to have Joe Jacobs on hand early in the morning at Vida, so that he could give Johnson a final "brush-up" on our transmitter, so that we would be sure to deceive Mr. Clark about Johnson being our licensed operator.

Naturally, Johnson knew very little about our transmitter, having seen it only once before. My brother, Paul, was in a terrible sweat, and later told me this was quite sufficient for him, and that he did not want to be "in" on any radio station venture of mine, ever.

Mr. Clark arrived on Number 2, Monday morning as scheduled, and I stalled around Wolf Point as long as I could in order to give Joe as much time as possible to "clue in" Johnson about our station at Vida.

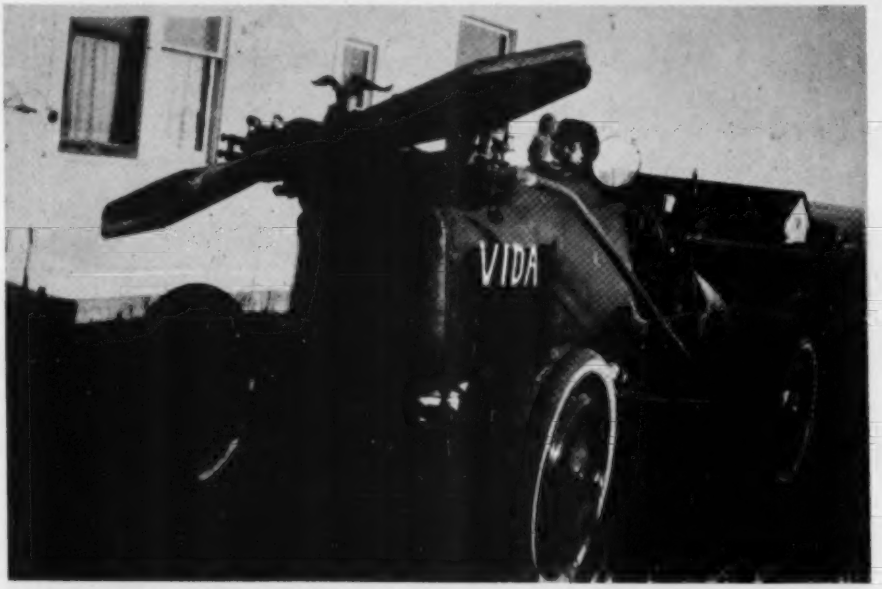
During the trip to Vida, I was preparing Mr. Clark for the shock he might get when he first viewed our transmitter at Vida, as it was just a cheaply assembled set. To all this, he said, "Well, don't worry about how the set looks as long as your broadcasts go out all right."

When we reached Vida, Joe Jacobs was sitting leisurely on the front steps of the bank, apparently unconcerned about the approaching dignitary from Seattle.

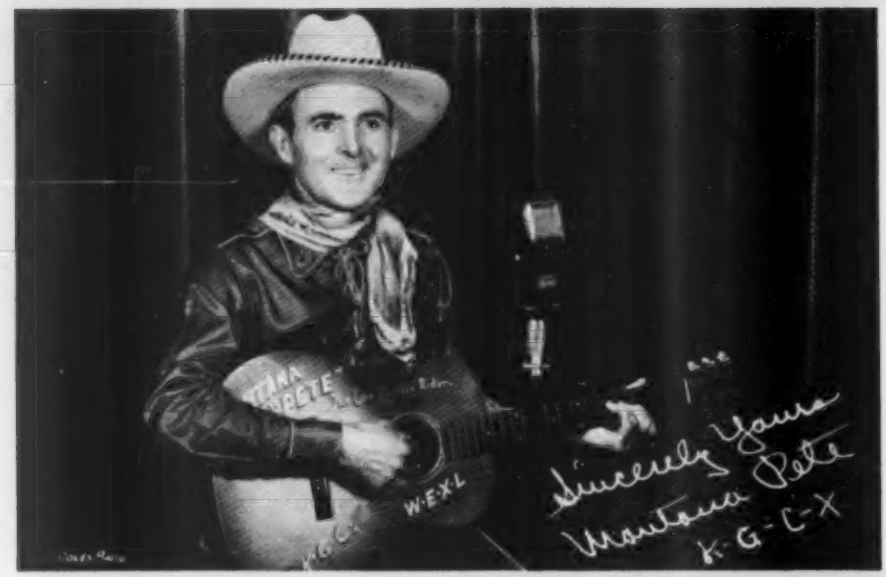
In the event that the radio inspector might happen to go into the village general store and Post Office, for any reason, and to help give the impression that Johnson was indeed a resident of Vida, who worked at the store when he was not on duty as the licensed operator of KGCX, a bit of flummery was arranged. So, when we arrived at Vida, Johnson was already in back of the counter at the store with his coat off, busily selling butter and eggs, and posing as a clerk in a store which he had just entered for the first time in his life. Obviously, the storekeeper was a part of the conspiracy to deceive the Department of Commerce, since he wanted Vida to be able to keep the radio station, as did everyone in the surrounding community.

Joe stepped into the bank with Mr. Clark and started his First Class operator's examination. I went over to the store and asked Johnson to come over to the bank. During Joe's examination, Mr. Clark inspected everything about our transmitter, the antenna system, etc., and asked Johnson to turn on the transmitter and transmit a phonograph record. This came through nicely, and the inspector then asked for an announcement through the micro-

Marcellus Jacobs poses to give prospective customers an indication of the size of the Jacobs wind electric plant.



Shown parked alongside the Vida bank is this unorthodox vehicle built by Joe Jacobs. Its airplane motor would whiz it over the prairies at 40 mph. In winter, it was equipped with skis. Note the antenna insulators and ground system of KGCX at the left. Seated in the vehicle is young Clair Krebsbach, now General Manager of 50-kW KERR.



Montana Pete performed for years on KGCX. When he departed for greener pastures, KGCX held a farewell party for him in the form of a barn dance, with live coverage of the affair provided by the station. Mr. Krebsbach, acting as master of ceremonies, intended to say into the mike, "We shall certainly miss Pete." Unfortunately, he transposed the first letters of the last two words. His profuse apologies to the hundreds of KGCX listeners, and to those present at the party, only made the situation worse.

phone. Johnson talked into the mike, but the inspector, who was listening on a radio in another room, said nothing came through. We were then using a desk-stand telephone as a microphone. Jacobs looked up from his exam papers and saw the telephone receiver hanging on the hook (which short-circuited the mike), and quietly told Johnson to take the receiver off the hook, which brought a faint smile to the face of Mr. Clark.

At dinner that evening in our living quarters in the bank, with Mr. Clark as a dinner guest, my young son had to help things along by telling his mother, *"Mama, Mr. Johnson is here again, isn't he?"*

It may be that Mr. Clark sensed that something was, indeed, amiss, but he said nothing. In any event, he was very nice to us, and Joe had passed his examination and all was well.

I was startled again at the ferry when we were returning to Wolf Point. Johnson, of course, had to return to Havre. Mr. Clark was going east. As I was starting home, Mr. Clark bid me goodbye *and on came Johnson to also bid me goodbye.* Rather strange for my operator to bid me goodbye.

I am sure that because of the remark my young son had made, and because Johnson bid me goodbye, there was little doubt in the mind of Mr. Clark that I had been operating KGCX without the services of a licensed operator. However, he said nothing.

We operated KGCX at Vida until February 1, 1929. At that time, I took over the Westland Oil Company agency at Wolf Point. I thought it would be very nice if we could continue operating a radio station in this area, so I applied to the Federal Radio Commission for permission to transfer the Vida station to Wolf Point. They replied that they would approve the transfer, but that they would not allow us to use the small 7½-Watt transmitter we had used at Vida. They told us we must use either 100 Watts or 250 Watts up to sunset, and 100 Watts after sunset. We first planned on 100 Watts, but Mr. Hooper, of Regina, informed us that a 250-Watt set would cost but little more, so we made application for that power.

We had no knowledge whatsoever as to what information we should put in the application relative to the rating of the tubes, the type of transmitter, and other such items, and this necessitated a trip to Regina to get the required information from Mr. Hooper, who was chief engineer of radio station CKCK, up there in Regina, Canada, about 175 miles north of Wolf Point. We made the trip via airplane, as the roads were impassible, and after going through some hair-raising experiences on the trip (two forced landings with a dead motor), we brought the necessary information back to Wolf Point and submitted our application to the Government.

We thought that we would have our construction permit in two or three weeks, but six weeks went by with no word from the Commission. I telegraphed Senator Walsh and Congressman Leavitt, in Washington, and within twelve hours I had a telegram from Mr. Leavitt advising me that the permit had just been granted and that we were assured a 250-Watt station in Wolf Point. ■

Author's note: The foregoing speech was never given a title by Mr. Krebsbach. It occurs to me that the name of a popular magazine would be an apt and accurate title for the subject speech, viz: *True Confessions.*

The village of Oberammergau, in Germany, is famous for its Passion Play, and the town of Hemet is well known in California for its annual outdoor Ramona Pageant, but for sheer audacity and raw courage on the part of its actors, the tableau just described, which was presented at Vida by Mr. Krebsbach, First Class Operator Johnson, the village storekeeper, et al, in attempting to deceive the Department of Commerce of the United States government, has no equal.

Joe Jacobs and his brother, Marcellus, did a great deal of experimenting with wind chargers on their ranch. Later, they established a large factory in Minneapolis and were able, through their 260 dealers, to sell twenty million dollars worth of wind chargers to farmers, airports and railroads throughout the world, an impressive accomplishment all stemming from the electrical tinkering of two young men on a Montana ranch.

Joe Jacobs passed away in 1962. In 1933, Marcellus invented the cathodic pipeline device which has saved pipeline companies millions of dollars. He still carries on electrical experiments in a large laboratory near Fort Myers, Florida, where another electrical tinkerer, Thomas A. Edison, developed many of his patents.

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CB to 10

—part XIX: Lafayette SSB rigs

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Recently, due to the extinction of 23-channel CB radios, several amateurs have converted SSB CB rigs to ten meters with great success. The fun of QRP operating, and the band openings lately, have contributed to their present popularity. The following information is a basic description of how to convert two of Lafayette's 23-channel SSB radios to ten.

The first step in any conversion is to decide on a frequency scheme. Since most SSB activity on ten seems to be around 28.6 MHz, and since the phone

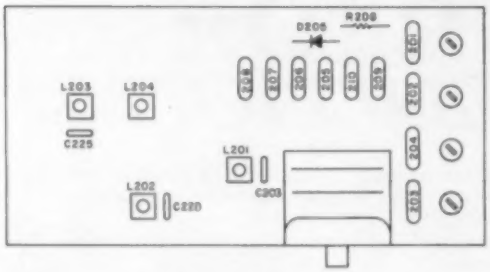

Fig. 1. Xtal-plexer.

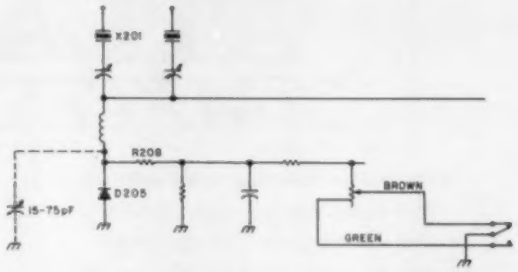

Fig. 2.

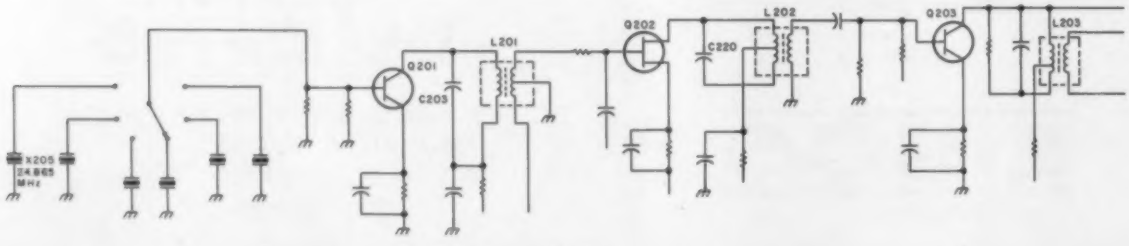

Fig. 3.

band begins at 28.5 MHz, I used the frequency/channel scheme shown in Table 1.

In order to produce the frequencies shown in Table 1, new xtals must be purchased and substituted for xtals x-205 through x-210. Table 2 shows the new xtals that must be installed.

The new xtals can be of the third-overtone type, which is less expensive than a fundamental type. Note that any one xtal will give you four channels, so if you need only 40 kHz of the band, only one xtal needs to be installed.

Channel	Frequency
1	28.500 MHz
2	28.510
3	28.520
4	28.540
5	28.550
6	28.560
7	28.570
8	28.590
9	28.600
10	28.610
11	28.620
12	28.640
13	28.650
14	28.660
15	28.670
16	28.690
17	28.700
18	28.710
19	28.720
20	28.750
21	28.760
22	28.770
23	28.800

Table 1.

Xtal #	Old Xtal	New Xtal
x-205	23.330 MHz	24.865 MHz
x-206	23.380	24.915
x-207	23.430	24.965
x-208	23.480	25.015
x-209	23.530	25.065
x-210	23.580	25.115

Table 2.

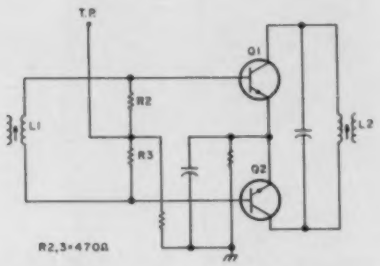

Fig. 4.

Installing the New Xtals

First, remove the old xtals directly behind the channel selector. I recommend the use of a solder wick, as the circuit board is very easily ruined by excessive heat. Next, install the new xtals in the proper locations. Note that the xtals are not in order. Locate C203, an 86-pF capacitor, remove it and in its place put a 68-pF mica capacitor. Locate C220, a 15-pF capacitor, remove it and in its place put a 10-pF mica capacitor. (See Fig. 1.)

Tuning Up the Xtal-plexer

Place the channel selector to channel 1. This switches x-205 and x-201 into the xtal-plexer's circuits. If x-205 is a 24.865 MHz xtal as specified, then tune L201 to resonance at that frequency. Measure the frequency and signal amplitude at the gate of Q207. Note that a 14.910 MHz signal is also present at the gate of Q207. If the 14.910 MHz signal prevents you from tuning the 24.865 MHz stage, then ground the source end of C219 (10 pF). Once L201 is tuned, begin tuning L202. (Remove the ground from C219 if you grounded it in the previous step.) The L202 stage should tune to resonance near 39.775 MHz. Measure frequency and signal amplitude at the collector of Q202. Next tune coil L203 for peak output, and measure signal amplitude at the cold end of C227 (1 pF).

Next, tune L204 for peak output, and measure signal amplitude at the base of Q17. Then go back and tweak L202 and L201 for maximum signal at the base of Q17 with the channel selector switched to channel 11 or at the center of your frequency scheme. Tweak L203 again for maximum output.

Receiver Tune-Up

Select channel 1. Inject a modulated signal at 28.5 MHz at the antenna connector or, if a signal generator is not available, connect a 10 meter antenna

Place the mode switch to AM and tune L18 and L19 for maximum audio output or maximum band noise. The S-meter can be used as a tuning indicator. Slowly decrease the injected signal strength, and tune L18 and L19 for maximum receiver sensitivity. This completes receiver conversion. Switch the mode switch to USB and run through the channels; if the band is open, and an antenna is connected, signals should be heard.

Fine Tuning Modification

There are two proven modifications to the fine tuning. One uses the original varactor diode circuit, the other requires that a variable capacitor be added.

Modification 1 is the easiest and requires only that the green wire on the fine-tune pot be moved from the tap to the wiper. The brown and green wires are both on the wiper after modification. This allows the transmit and receive frequencies to track together ± 600 Hz.

Modification 2 requires that a 15-75-pF variable be mounted in place of the fine-tune pot, and that D205 and R208 be removed from the xtal-plexer board. (See Fig. 1.) A wire from the variable capacitor is connected to the circuit board where the cathode of D205 was originally. This modification allows the transmit and receive frequencies to track ±2.5 kHz. (See Fig. 2.)

Transmitter Tune-Up—USB and AM

Place the mode selector

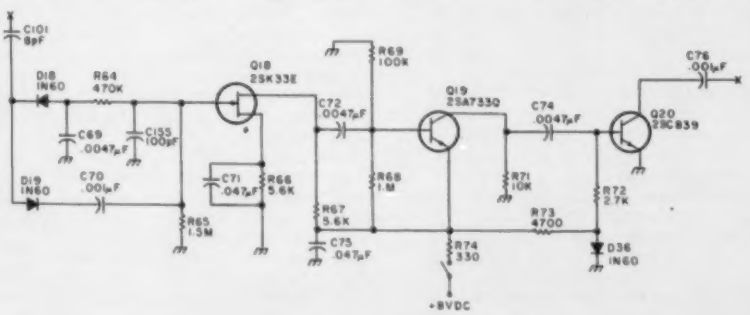

Fig. 5.

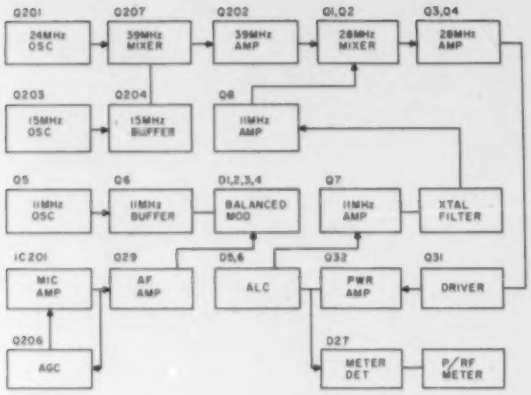

Fig. 6. Transmit USB.

switch in the AM position. Connect a dummy load to the antenna connector through a power indicator. Now, while keying the mike, adjust L2 for maximum output of rf. This will be fairly low, perhaps less than 1 Watt. Next, in order, tune coils L3, L4, L5, L7, and L6 for maximum rf output. In the AM mode, full output power is about 3.8 Watts with 13.8 V dc supplied. Switch the mode switch to USB and whistle into the mike. About twice the rf should be indicated on the output. Remember to check the frequency of the rf at the antenna. Remember also that 28.5 MHz USB is very close to the phone band's edge!

Transmitter Tune-Up—LSB

This part of the conversion is optional. If LSB is desired, follow the next few steps. Change C131 to 36 pF and change C91 to 36 pF; put the removed C91 (39 pF) in place of C94 (47 pF). Place the mode selector in the LSB position. Key the mike, remembering to use a 50-Ohm dummy load on the antenna. Tune L15 for maximum rf. The frequency should be about 17 MHz, depending on the channel you have selected. Tune L16 and L17 for maximum rf while monitoring at the junction of R2 and R3. (See Fig. 4.) Now modulate the rig. An LSB signal should be present at the antenna. Check the receiver for good sensitivity. It may be necessary to retweak L15, L16, and L17 for best results.

Noise Blanker

Lastly, I noted that the SSB-75 does not incorporate a noise blanker circuit, although the SSB-100 does. Actually, the foil pattern for the blanker is on the SSB-75 circuit board, and the components can be added for less than $10.

A schematic of the blanker used in the SSB-100 is shown in Fig. 5. Components are common, but substitution of semiconductors is not recommended. These exact semiconductors are available from Fugi Svea Electronics.

Summary

This collection of notes is provided for your information, and may not work in all SSB-series radios. However, two SSB-75s are now on the air at this QTH and working like champs. Good luck! If you run into trouble during this conversion, drop me a line, and maybe I can help. 73.■

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PERFORMANCE: You can run up to 3 KW PEP and continuously match any feedline from 1.8 to 30 MHz: coax, balanced line or random wire.

FEATURES: A 10 amp RF ammeter insures maximum power to antenna at minimum SWR.

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A flexible antenna switch lets you select 2 coax lines thru tuner and 1 thru or direct, or random wire, balanced line or dummy load.

A 200 watt 50 ohm dummy load lets you tune your exciter off air for peak performance.

All metal, low profile cabinet gives RFI protection, rigid construction. Black. Anodized aluminum front panel. 5x14x14 in. 20 pounds.

A flip stand tilts tuner for easy viewing.

Efficient, encapsulated ferrite 4:1 balun. 500 pf, 6000 volt capacitors. 18 position dual inductor, 17 amp ceramic rotary switch. 2% meters. SO-239 coax connectors. Ceramic feedthru for random wire, balanced line. Binding post for ground.

QUALITY: Every single unit is tested for performance and inspected for quality. Solid American construction, quality components.

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Amateurs are always looking for ways to add a little extra punch to their signals. I guess it's just a natural inborn ham instinct to want to be louder than the other guy. And, of course, one of the most popular methods to get just a little bit more out of that transmitter is through speech processing.

There have been countless articles written on this type of signal enhancement, but many are very complex and present problems to the casual builder. This processor, however, while very simple and inexpensive, is highly effective. The builder can expect to see a 2-5-dB improvement in signal strength. The total cost of this project should be no more than ten dollars, using all new components.

The processor is constructed on perfboard, wired point-to-point, and enclosed in a metal box. The individual builder, however, may wish to design and etch a circuit board, or incorporate the unit directly into the transmitter. The input, output, and voltage-switching circuits have been left unfinished. The builder may want to incorporate a switching network of his own design.

The authors have used this processor in many contest and DX situations, and have received nothing but glowing reports from listeners. This simple, inexpensive processor should make a worthwhile addition to nearly any station. ■

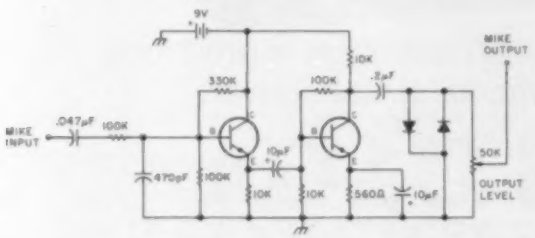

Fig. 1. The processor circuit. Transistors are 2N408, GE2, or Radio Shack RS2004. Diodes are any germanium diodes, such as 1N270.

Parts List

1 330k
3 100k
3 10k
1 560Ω
1 50k pot
1 .047 uF
1 470 pF
2 10 uF electrolytics
1 .2 uF
2 2N408, GE2, or RS-2004 transistors
2 1N270 diodes or similar
Box, hardware, switches

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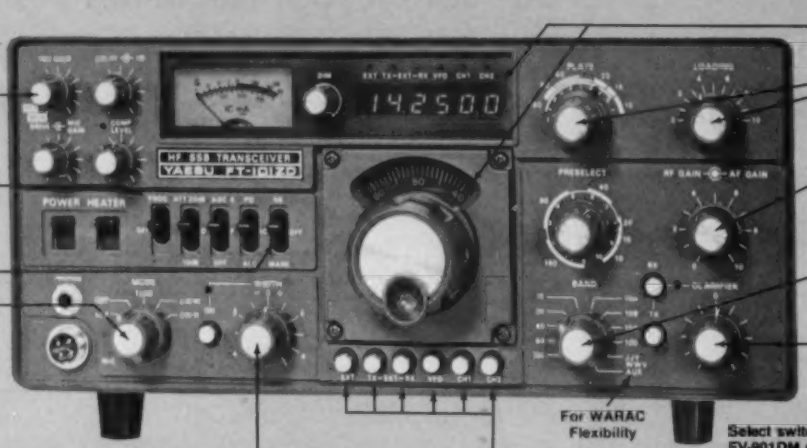
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Full band coverage: 160 through 10 meters, plus WWV/JJY (receive only)
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PA Input Power:
180 watts DC
Carrier Suppression:
Better than 40 dB
Unwanted Sideband Suppression:
Better than 40 dB @ 1000 Hz, 14 MHz
Spurious Radiation:
Better than 40 dB below rated output
Third Order Distortion Products:
Better than −31 dB
Transmitter Frequency Response:
300-2700 Hz (−6 dB)
Stability:
Less than 300 Hz in first 30 minutes after 10 min. warmup; less than 100 Hz after 30 minutes over any 30 min. period
Negative Feedback: 6 dB @ 14 MHz
Antenna Output Impedance:
50-75 ohms, unbalanced

GENERAL

Frequency Coverage:
Amateur bands from 1.8-29.9 MHz, plus WWV/JJY (receive only)
Operating Modes:
LSB, USB, CW
Power Requirements:
100/110/117/200/220/234 volts AC, 50/60 Hz; 13.5 volts DC (with optional DC-DC converter)
Power Consumption:
AC 117V: 75 VA receive (65 VA HEATER OFF) 285 VA transmit; DC 13.5V: 5.5 amps receive (1.1 amps HEATER OFF), 21 amps transmit
Size:
345 (W) × 157 (H) × 326 (D) mm
Weight:
Approximately 15 kg.

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Sensitivity:
0.25 uV for S/N 10 dB
Selectivity:
2.4 KHz at 6 dB down, 4.0 KHz at 60 dB down (1.66 shape factor); Continuously variable between 300 and 2400 Hz (−6 dB); CW (with optional CW filter installed): 600 Hz at 6 dB down, 1.2 KHz at 60 dB down (2:1 shape factor)
Image Rejection:
Better than 60 dB (160-15 meters); Better than 50 dB (10 meters)
IF Rejection:
Better than 70 dB (160, 80, 20-10 m); Better than 60 dB (40 m)
Audio Output Impedance:
4-16 ohms
Audio Output Power:
3 watts @10% THD (into 4 ohms)

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From tube to transistor—without tears.

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Don't misunderstand me. There's nothing technically wrong with the old Knightkit grid-dip meter. It's just that whenever I wanted to measure the frequency of a coil, the ac line cord was too short or I would invariably drape the power cord across a simmering soldering iron, nearly electrocuting myself.

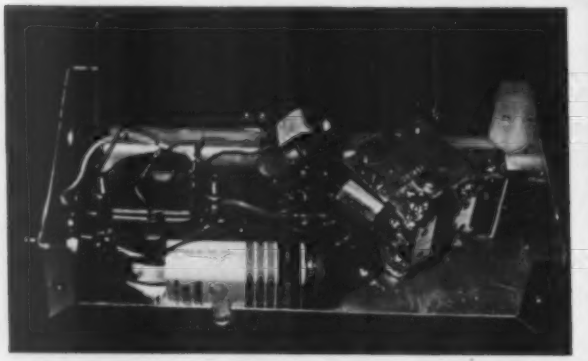
So, something had to give, hopefully the line cord. And it did, but not as quickly as initially planned. About a year ago, I started noticing an abundance of articles proclaiming the miracles of field-effect transistors (FET) and bipolars replacing tubes in many simple circuits. Then the light dawned and I planned my attack. After all, I needed a portable, cordless gdo to take to my beam antenna for measurements, and to get into tight spots in other electronic projects.

Needless to say, not all attacks are successful, and my first few weren't. Oh, I managed to transistorize the beast alright, but ended up with numerous false dips and erratic meter readings. Plus, the dial left much to be desired as far as accuracy goes. Since I had just completed a frequency counter, more lights began dawning.

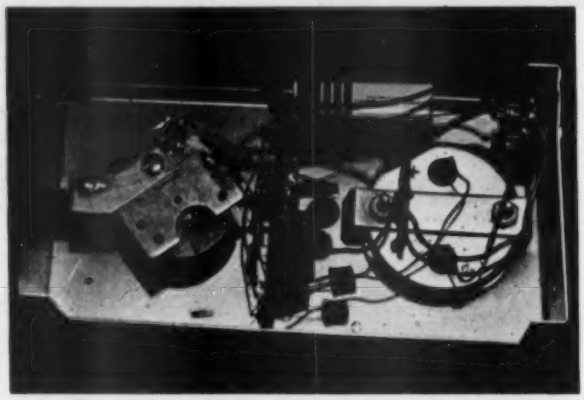
About the same time that I was mentally abusing myself for being so stupid as to louse up a perfectly good tube gdo just because it had an ac line cord, Fred Teague W4RHJ showed me a breadboard gdo circuit he was playing with. I tried it, making a few modifications for my particular needs, and, amazingly, it worked the first time.

Since I had already stripped the bulky tube components from my

Photos by KA4AAH



Side view of gdo, showing existing tuning capacitor, battery, and vertically-mounted perfboard with circuit.



Top view of gdo, showing vertical mounting of perfboard transistor circuit and main tuning.

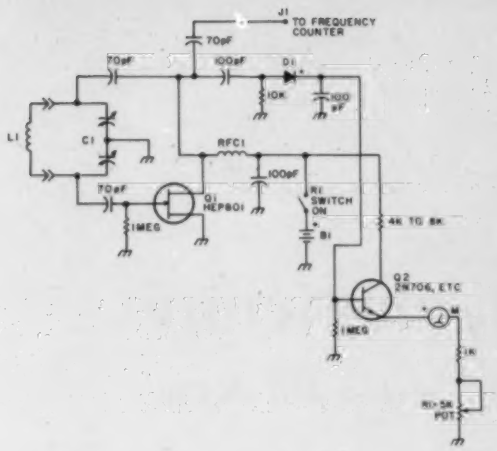


Fig. 1.

View of converted tube gdo, showing normal selection of coils.

Knightkit, it was a simple matter to clean up the breadboard version and install the small perfboard circuit vertically in the Knight case. About all I kept from the original were the case, coils, variable capacitor, meter, and the combination switchpot.

You'll find the new circuit to be simple, noncritical concerning parts, and reliable if good, sensible rf wiring is followed.

One of the novel features is the placement of diode D1. Through the pick-off capacitor, it rectifies a small amount of rf and drives the meter amp. Many circuits have it reversed, but this method allows using a less expensive transistor since we're dealing with dc and not rf. It makes the circuit less critical, too. Another feature is an rf pick-off used to feed a frequency counter. This allows you to read the dip from the meter and glance over at the frequency counter for the numbers. Super accuracy. Of course, you should retain the existing Knight dial for those times when you're hanging off the tower trying to get a dip on your new beam's frequency. At times like that, you sure don't need another piece of equipment like a frequency counter bonking you in the head as you dangle from the tower.

If you wind your own coils and build the unit from scratch, use ½-inch forms with an RCA pin plug on the bottom and a matching plug on the gdo. The lower frequency coils use thin Litz wire and the higher frequency jobs use #24 wire, progressing to #22 wire for the highest range coil. Using a frequency counter, you can calibrate the dial right on the money.

Personally, I couldn't get along without mine now. And by the way, this tale does have a moral. Actually, it has two. First: Don't throw anything away which can be converted. Second: If the conversion doesn't work, don't despair. A better circuit will come along in the future. Welcome to the future; here's your better circuit. ■

Parts List

L1-L6—Existing coils from Knight grid-dip meter, or custom-wound coils can be wound on ½-inch forms
C1—Dual 50-pF variable, retained from original circuit
D1—1N914, or similar
Q1—ECG 132 Sylvania, or similar HEP
Q2—NPN garden variety
B1—Nine volt battery
RFC—1 mH
All resistors 1/8 Watt, capacitors in pF (mmf) unless specified
M1—Existing meter in Knightkit, or 1 mA basic dc movement
J1—Pin jack

Coil Information

1.5-3.5 MHz	75 turns, pi-wound Litz, three pis
3.0-8.5 MHz	30 turns, 3-pis Litz wire
8.5-20 MHz	30 turns, #24 close wound, ½-inch form
19-45 MHz	12 turns, #24 close wound, ½-inch form
45-115 MHz	4 turns, #22, spaced over 1 inch, ½-inch form

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Reader Service—see page 195

You Ought To Be in Pictures

—here's what the guys on 14,230 are doing

The status of SSTV.

Dave Ingram K4TWJ
Eastwood Village, #1201 South
Rt. 11, Box 499
Birmingham AL 35210

The ever-increasing number of slow-scan signals being observed on our high-frequency bands is factual evidence of this mode's acceptance by amateurs around the world. Visual communications, with its modern reflections of a "Golden Age in Electronics," obviously inspires many innovation-minded amateurs. It is indeed refreshing to see such technical proneness gain popularity in this modern computer age. Many technical and operational expansions have favorably affected the world of SSTV recently. This article is presented as an "update account" of these expansions. Some of the more prominent technical innovations will be considered first, then I will discuss the operational and future aspects of slow-scan TV.

This SSTV picture, which was received from Dick K6SVP, shows the Voyager spacecraft approaching the planet Saturn. The large white object in the top right-hand corner of the picture is a parabolic dish on the spacecraft. The "gear"-looking item on the left of the Voyager is part of the unit's probe. The "snow" at the top of the picture was due to noise on 20 meters.

Digital-Scan Conversion

The unlimited expansions associated with digital scan conversion have definitely established this method as the ultimate technique for serious SSTV work. Home-brew scan converters, however, are becoming somewhat scarce in the US since Robot's Model 400 gained popularity. This is simply because one cannot build a slow-to-fast-scan converter (with its associated 65K of memory) for less money. Building a digital scan converter without the use of prefabricated PC boards is also a hair-pulling experience.

Robot's 400 is perfectly suited for technical expansions, the most promising one presently being dual 65K memories. This approximately $180 addition can be used for implementing real-time color, restricted motion, and special processing of interference-ridden pictures. Dr. Don Miller W9NTP and Dr. Robert Suding WØLMD are presently the leading pioneers in these areas. (W9NTP may still have these "second memories" available. If interested, send Don a large SASE for full details.)

Medium-Scan TV

One of the most outstanding new concepts to affect our world of visual communications recently is the evolution of the medium-scan TV system. This super-expansion of SSTV combines the best features of both the fast-scan and slow-scan worlds and results in a high resolution-motion TV system capable of international communications. The prime instigators of this system are W9NTP, W3EFG, WB8DQT, W6MXV, and WØLMD. Additionally, W9NTP has demonstrated this system to several European amateurs interested in operating

medium scan from their areas. The prime objective of this amateur "special interest group" is to be the first to effect transatlantic communications with live, motion TV.

Technically speaking, medium-scan TV is a 128 horizontal line by 128 vertical pixel double-interlaced system with a 35-kHz bandwidth. There are 7.5 fields transmitted each second, and a 4-bit sync code is used to designate the specific fields. Color may be employed with this system by properly encoding each field with red and green signals while also integrating the black and white components to produce the "Y" signal. Special Temporary Authorization from the FCC has been granted to the previously-mentioned amateurs to permit transmissions of these wideband signals on the high end of 10 meters.

A simplified block diagram of medium-scan TV is shown in Fig. 1. Since narrowband FM is employed in this system, some easily assembled circuits and an ordinary FM receiver replace the station's regular high-frequency transceiver. A Robot 400 or similar scan converter with dual 65K memories is used to decode and reconstruct the received pictures and present them to a conventional fast-scan television.

Simultaneous Audio and Video

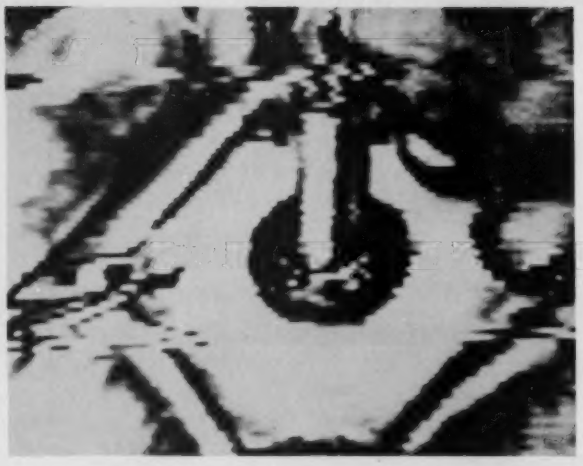
Several techniques for multiplexing sound and SSTV have been investigated, but this form of communication hasn't yet gained widespread acceptance. The simplest and least expensive method of multiplexing audio and video involves using a Motorola MC1596 in its conventional AM modulator/demodulator configuration. These circuits are included in recent issues of Motorola's applications notebooks.

Single-Memory, Compatible-Color SSTV

Mike Tallent W6MXV has been developing a single-memory color system which has substantial promise for SSTV use. This system, which is fully compatible with our existing black and white SSTV system, employs slight modifications of the R-Y, B-Y parameters used in conventional fast-scan TV concepts.

Initially, a 737.5-Hz color subcarrier is modulated in quadrature (in phase and 90 degrees out of phase) with color-difference information, while luminance SSTV modulates the regular 1500- to 2300-Hz bandwidth. At the receiving end, a continuously-transmitted color pilot signal is processed and used to reproduce the color-burst phase reference and control clocking of the D-to-A converter. Basically, this concept permits the interlaced and phase-shifted color information to be loaded in main memory along with the regular SSTV. Next, this information is accelerated to fast-scan rates, removed, and used to construct R-Y, B-Y, and Y signals which drive a conventional fast-scan TV.

While Mike's system suffers the same problems associated with our present NTSC (fast-scan) system (high black and white resolution but poor color resolution), it has the definite advantage of low-cost compatible color. This experimental concept may well prove to be tomorrow's accepted method for real-time color SSTV.



This is an SSTV picture of a human eye operation. The operation jig which holds the probe is fitted to the eye during such operations as cutting the pupil area and inserting a new lens. The picture was the first of a series received from Dave W5DUU.

The Software Situation

There is a natural tendency for specialized modes of communication such as SSTV to attract a larger number of technically-oriented amateurs than on-the-air operating enthusiasts. As a result, SSTV developments have outpaced meaningful on-the-air usages. Naturally, we would like to encourage more "applications-oriented" video enthusiasts to join our ranks. If you have ideas or are involved with activities which can be shared with others through visual communications, the world of SSTV is a haven for endless opportunities. Possibly the following brief discussion of some recent amateur accomplishments with SSTV will help spur your thoughts along these lines.

N6V and the gang at the Jet Propulsion Labs were true pacesetters of SSTV programming with their on-the-spot reports and views of Mars during 1977. The JPL gang is continuing these activities during 1979 with SSTV retransmissions from the *Voyager* spacecraft on a mission to Jupiter, Saturn, and Uranus.

Dave W5DUU, an accomplished eye surgeon in Texas, frequently transmits pictures of human eye operations which are fascinating to view. Dave's accompanying explanations

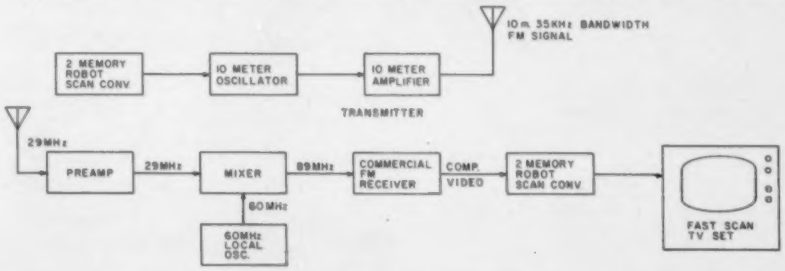


Fig. 1. W9NTP medium-scan TV system which may be used on the high end of 10 meters.

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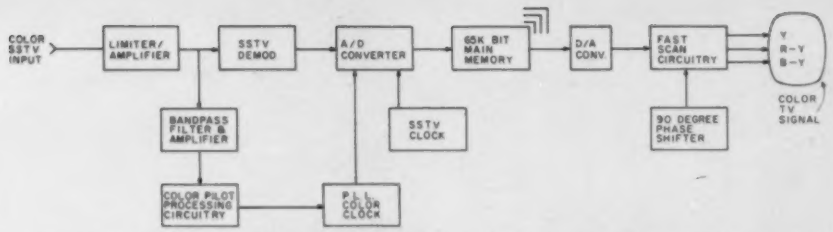

Fig. 2. Simplified block diagram of W6MXV single-memory color SSTV system.

of these operations provide a detailed account of modern optical techniques.

Meanwhile, W1BGW continues retransmitting SSTV pictures received from our weather satellites, W6KZL shows his hydroponic greenhousing, and XE1JOF describes the Mexican pyramids and points of interest in his area.

These examples of SSTV applications illustrate many aspects which are possible when our mode is effectively put to use. We need to see more transmissions of this nature on the HF bands.

ISSS

During early 1978, I began planning to form an International Slow-Scan Society. The prime objective of this organization will be to affect SSTV expansion and acceptance from both technical and operational standpoints on a worldwide basis. Thus far, a number of slow scanners have joined in this effort (providing whatever services are consistent with their interest and ability), and we have established liaison with countries in four of the six continental areas. Eventually, we plan to sponsor our own contests and activities, provide an SSTV "newcomer assistance" service, establish hardware and software library services (which will function like QSL bureau systems), produce a quarterly SSTV newsletter, and much more. Naturally, we need the support of all active slow scanners to ensure that these plans succeed. If you are interested in supporting ISSS, send me one or two SASEs and a brief note describing your particular areas of interest. Your first SASE will be returned when the next ISSS newsletter is produced, and the other SASE will be held until a subsequent newsletter (or specifically requested information) is available.

I would like to hear particularly from amateurs interested in joining my ISSS plans to assist some poverty-stricken areas in our "third world." Some countries are not self-sufficient because their yearly rainfall will not support the needs of their populations. Missionaries and engineers try to teach the inhabitants modern techniques of water engineering—irrigation, contour farming, and so on, but their success is somewhat restricted by a lack of native acceptance. This is an ideal chance for SSTV to prove its merit while also helping mankind!

Getting Started in SSTV

I hope that many non-slow scanners are reading this article out of curiosity, and I would like to encourage you to investigate the fascinating world of SSTV. An "arm and leg" investment isn't necessary for one to equip his station with slow-scan capability. The W6MXV monitor, for example, performs very well and costs approximately $100 to build.

Another great homebrew unit is the WØLMD video-sampling monitor. Larry Prior WA9MFF sells PC boards for this outstanding P-7-type unit. Amateurs interested in "going first class" can purchase a Robot 400 for approximately $700 and be set for any innovations that may evolve in the foreseeable future. If you don't care to purchase a commercial video monitor to use with the 400, Robot's optional VHF oscillator will allow this scan converter to drive your regular TV set via its antenna terminals. I've used this method for several months with my 400 and Sony TV, and it works great.

Summary

The world of SSTV continues to be a wide-open field for amateurs interested in enjoying new modes of communication. It has reached a high degree of technical advancement and become an accepted mode of long-distance visual communication. We are now interested in using this mode to its fullest capability and sharing our world with others.

Whether you are a technical innovator or operating enthusiast, consider this article an open invitation to join our ranks. If you need additional information or assistance, simply contact our SSTV net which meets each Saturday at 1800 GMT on 14,230 kHz . . . or ask any SSTVer. ■

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How to Toot Your Own Horn

—and stay on key

Try out this simple pitch generator.

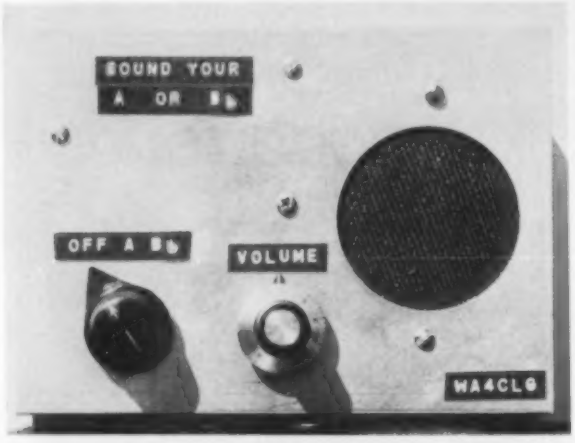

Photo 1. Front panel of completed standard pitch generator.

Chances are that if you are not a musician, then you probably have a "harmonic" who is. But if not, you just gotta have musical relatives or friends! So, you are bound to find some use for a simple electronic circuit which produces an accurate "A" or "B♭" for tuning orchestra or band instruments.

Construction is easy, and will not take much time to complete. See Fig. 1. The oscillator is quite standard; it is one shown by Jan Crystals on their catalog sheet. The oscillator produces 4400 kHz or 4662 kHz.

Through the use of four 7490 ICs, a dividing circuit is set up whereby the oscillator frequency is divided by 10,000. This gives you 440 Hz and 466 Hz. These are, of course, in the audible range and are the musical tones "A" and "B♭"—tuning frequencies used by band and orchestra instruments.

The photos and drawings are self-explanatory. You should have no problem putting the components on the .1" x .1" perfboard (Fig. 2). Also, a drilled PC board is available for $5.18 postpaid from Rick Allran, PO Box 974, Waynesville NC 28786.

I used sockets for ICs and the transistor. It is recommended that you use wire-wrap IC sockets since the extra length of the terminals allows easier solder attachment of the wires. Of course, you can wire-wrap if you like. An octal

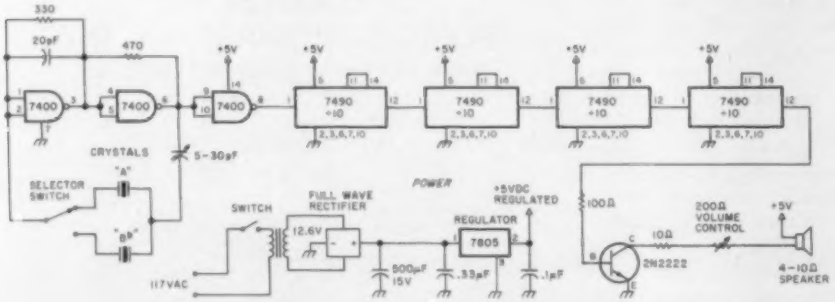

Fig. 1. Schematic of pitch generator and power supply.

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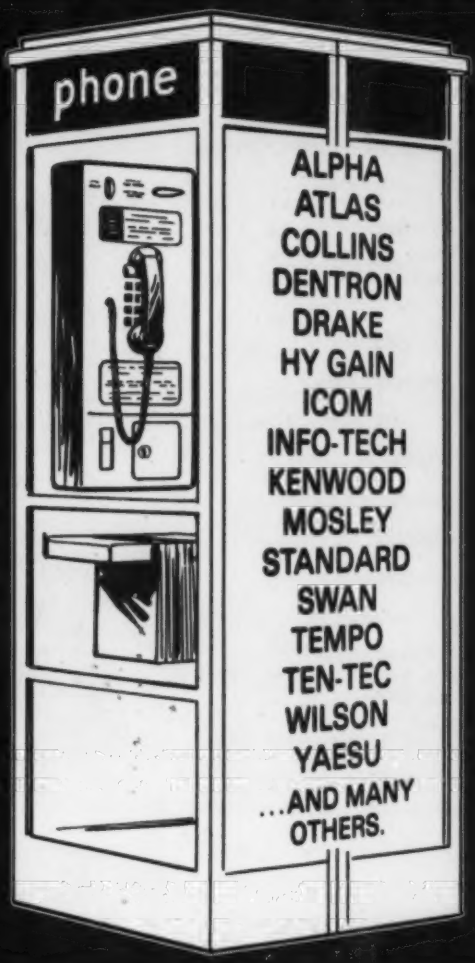

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socket is used for mounting the two crystals. I removed the unused socket terminals. Proper drilling of the perfboard allows you to mount the octal socket by bending the terminals.

The crystals I used were not expensive specials—simply .005% accuracy. They are in the $2 class.

When the perfboard is completed, you can mount it and the other components in any suitable cabinet. The power supply is my version of a compact "Japanese" assembly, mounted on a 3-lug terminal strip. Photo 2 and Fig. 3 show this neat setup. The voltage regulator socket (a transistor socket), filter capacitor, rectifier, and bypass capacitors, are all mounted together. The cabinet acts as the heat sink for the voltage regulator.

If you have trouble finding a cabinet, as I did, the Radio Shack chassis in the parts list is an economical substitute. I closed the back of the chassis cabinet with a piece of perfboard. You can add a ¼-Amp fuse to the 120-volt ac power input. For true portability, the unit could be powered with batteries, in which case you should use the alternate ICs listed—the 74C00 and 74C90s—because their current drain is less.

I selected the volume control value to allow some audio to be heard even when set at minimum. This helps you to remember to turn off the unit.

When you have the project buttoned up, you are ready to sound a near-perfect "A" or "B♭". You can be sure you're in tune when you match this tuner.■

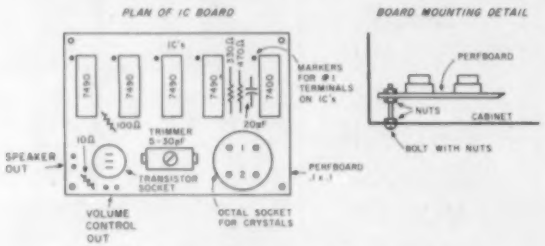

Fig. 2. Component layout.

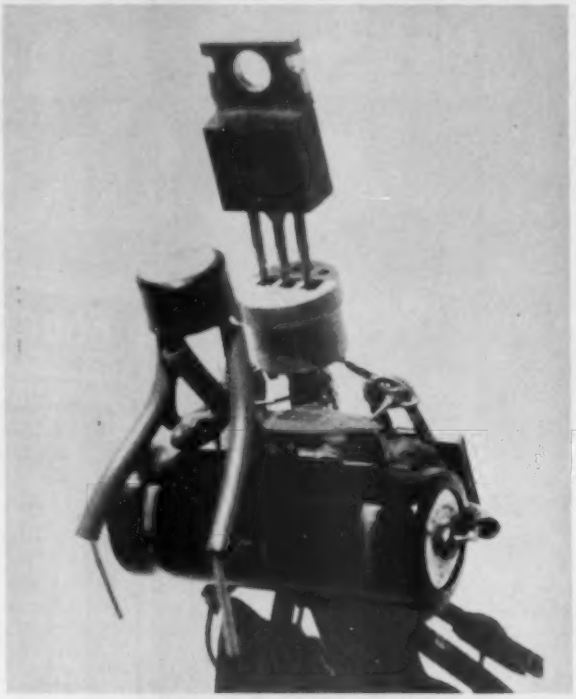

Photo 2. Method of mounting power supply components.

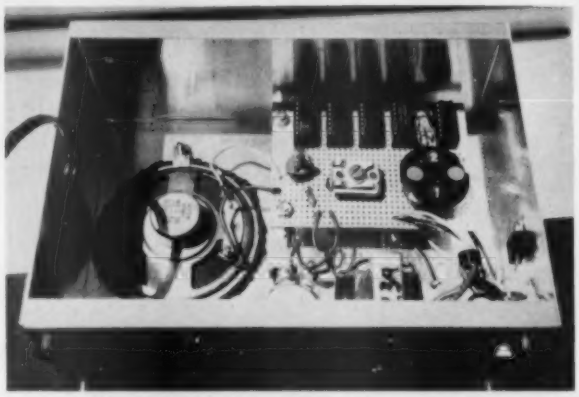

Photo 3. Interior of standard pitch generator.

Parts List

1—7400 IC. } Consider low-current ICs such as
4—7490 IC. } 74C00 and 74C90, if battery supply is used.
1—4400-kHz crystal, Jan .005%, or equivalent.
1—4662-kHz crystal, Jan .005%, or equivalent.
1—Selector switch, 2-pole, 3-position. Use Radio Shack #275-1386. Omit 3 positions.
1—2N2222 Transistor.
1—Speaker, miniature—4-10 Ohms.
5—IC sockets, 14-pin wire-wrap.
1—Resistor, ¼-Watt, 330 Ohms.
1—Resistor, ¼-Watt, 470 Ohms.
1—Resistor, ¼-Watt, 10 Ohms.
1—Resistor, ¼-Watt, 100 Ohms.
1—Volume control, 150-200 Ohms.
1—Trimmer capacitor, 5-30 pF.

Power

1—Transformer, 117/12.6 volts—300 mA or higher.
1—Full-wave rectifier, 1A, 50 volts or higher.
1—Regulator, 7805 (5 volts).
1—Capacitor, 500 uF, 15 volts or higher.
1—Capacitor, .33 uF tantalum.
1—Capacitor, .1 uF (disc).
1—Perfboard—3½" x 2¼", with .1" x .1" perforations.
1—Cabinet (Radio Shack Chassis #270-247).
1—Cabinet back.
1—Line cord—117 volts, with plug.
Misc.—Grill cloth, bolts, nuts, cabinet feet, markers, etc.

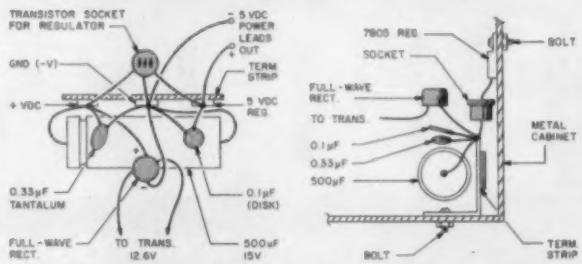

Fig. 3. Power supply component mounting details.

The Scanning Memorizers

FT-127RA
(220 MHz)

FT-227RB
(144 MHz)

FT-627RA
(50 MHz)

The FT-127RA, FT-227RB and FT-627RA, FM transceivers, allow scanning and expanded memory coverage for the demanding VHF FM operator. All feature up/down scanning capability with control from the microphone; the scanner will also search for a busy or clear channel. Four memory channels are available — two for simplex, three for repeater channels,one for a split of up to 4 MHz. Other performance features are similar to those of the renowned FT-227R.

OPTIONAL EQUIPMENT

Keyboard Microphone: YM-22 for FT-127RA and FT-627RA; YM-23 for FT-227RB (YM-22 standard feature with FT-227RB) • Squelch Unit • FP-4 AC Power Supply

CPU-2500R/K 2 M FM Transceiver
with Central Processing Unit

The age of computers has entered the amateur scene with the announcement of the CPU-2500R/K 2-meter FM transceiver. Controlled by a 4-bit central processing unit (CPU), the CPU-2500R/K contains a scanner, 4 memory channels, manual or automatic tone burst, an optional sub-audible tone squelch, and 25 watts output.

The keyboard microphone allows two-tone input for autopatch or control purposes, as well as remote programming of dial or memory frequencies.

Automatic ±600 kHz repeater split, or program a split up to 4 MHz using the memory. Keyboard microphone allows remote programming of odd splits.

CPU scanner will search for a busy or clear channel, upon your command.

Four memory channels for simplex or repeater use, plus another memory channel for a split of up to 4 MHz.

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A Junk-Box HT Charger

— power to the portables

Very nice at a $5 price.

Sunny Mitchell WB9JLY
Box 438
Sparta WI 54656

Wouldn't it be nice to have a charger for the Wilson HT on the bedside stand, in the living room, garage, or wherever else you might like to monitor? This would allow you to listen and still keep your batteries charged so you could pick it up and go.

I decided that I would like one, so I checked the spare parts department (junk box) for necessaries and home brewed a cheap charger that works as well or better than the factory model.

Its features include:

Constant charge rate in both high and low mode;

Low charge rate adjustable so batteries will stay charged while monitoring;

Use of voltmeters and milliammeters if desired and available, but they are not necessary (more on this later).

Construction

Any small box will hold the parts; I prefer the 5¼" × 6" × 3" box from Radio Shack. The transformer should deliver about 25 volts at the secondary. I found one with 48 volts center-tapped and used one side for 24 volts. A bridge rectifier is used. The capacitor value is not critical; in fact, you can even leave the capacitor out and the charger will work. I measured the current drain of my Wilson (in standby) and found it to be 25 mA instead of the 14 mA stated in the specs, so I adjusted resistance to give 30 mA on low charge and 55 mA on high charge. This is about the correct rate (50-60 mA) for slow-charging AA nicads. You could fast-charge at 150-200 mA without any problems, but I think it is easier on the cells to use the slow rate of about one-tenth the Amp-hour capacity.

A 0-15-volt dc meter is a helpful option across the output terminals to determine the condition of the cells. At full charge, the meter will show approximately 14 volts with the HT in the charger. Also, the condition of the cells is determined by the voltage drop observed by transmitting with the Wilson in the charger. If the cells are good, a 2½-Watt HT will cause a voltage drop of ½ to 1 volt. If the voltage drop is much greater, it is probably caused by a weak or dead cell. A milliammeter is an option, but one should be used to adjust the values of resistance to set the proper charge rate when constructing the charger.

The problem of contacts for the charge terminals on the bottom of the Wilson is solved by using a barrier terminal strip and spade lugs bent to 90 degrees with a short length of #12 solid copper wire soldered into the spade lugs. The hole in the top of the case is cut with tin snips and the edges are smoothed and covered with rubber molding or tape. Pop rivets are handy for mounting the barrier strip and transformer, and a hot-melt glue gun can be used to hold some small parts. The 100-Ohm voltage divider makes adjustment of high-low charge rates simpler. Be careful to handle the 110-volt primary side of the circuit with care. I advise grounded plug and chassis, a fuse at one Amp, and the use of a microswitch to turn the primary on/off when the charger is in or out of use.

It is also a good idea to insulate or cover all 110-volt connections inside the case. Don't forget the rubber grommet to protect the power cord and to provide some sort of strain relief (a knot will do).

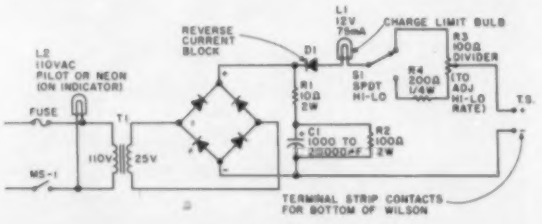

Fig. 1.

Summary

The fourth charger I built was completed in about two hours from mostly junk parts, and it works like a charm. So get busy and have some fun building one or more. They are not critical; just watch the milliamp charge rate. Considering that the commercial version is about $40, these are very nice at about $5, depending on what you find in your junk box. I found the box, which I bought, to be the most costly item at about $4. ■

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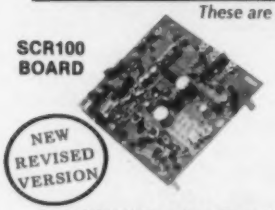

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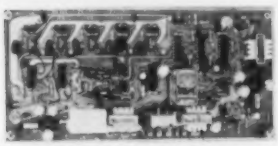
- SCR100 mounted in shielded housing
- Same as used on SCR1000
- Completely asmbld. w/F.T. caps, SO239 conn., AF GAIN POT, etc. $205.00



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- 6 Hi Q Resonators with FET preamp.
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- Selectivity: −20 dB @ ±2.0 MHz; −60 dB @ ±6 MHz (typ.). $85.00

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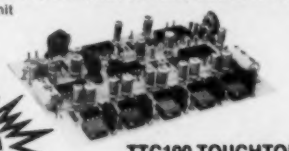

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TTC100 Touchtone Control Board

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So you've finished your latest project. Now you're ready to label it. A popular way to do this is to use rub-on lettering, such as Letraset. This gives a professional look to your work, something which is impossible with label-makers. But with Letraset, your project will soon look awful if you don't protect the lettering from scratches. To overcome this problem, many builders spray their panels with Krylon or some equivalent. This is the method I used until I came across one which I believe to be better.

The method I use now is to cover the panel completely with the material which is used to cover identification cards and other things. Basically, this stuff is clear plastic with an adhesive backing. While more expensive than using clear spray, the method does have the advantage that only a very sharp instrument can scratch either the lettering or the panel.

The material I used is called "Protecta." It costs me $2.50 for a sheet 18 by 72 inches. This, or another brand, should be available just about anywhere. Just go to your local stationary store and ask for that adhesive plastic stuff which is used to cover ID cards and books.

Now for some info on using this panel-protecting method. First, be sure that the panel is clean and that all the holes have been deburred. Is the lettering just as you want it? Adhesive plastic is fairly permanent. If you want to remove it later, you will have to discard it, and you may even pull off some of the lettering.

The next step is to cut the plastic to size, with about ¼ inch extra on each side. Pull the paper backing from the plastic. Apply the plastic to the panel slowly and evenly. Watch out for air bubbles. If you see any of these, pull off the plastic a bit and reapply it with some pressure. With luck, you now have the plastic down with no air bubbles.

Go over the panel, applying pressure all over. Turn the panel over onto a solid surface. Use a sharp knife to cut the excess plastic from the edges of the panel. Once again turn the panel over, so that the plastic is facing you. With the sharp knife, clear out the holes. Use a downward motion and cut the plastic right at the edges of the holes. For the smaller holes, the knife may not work too well, and I'd suggest using a sharp, tapered instrument such as an ice pick. Simply push the implement through the plastic until it fits the hole. Now your panel is ready. ■

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204MK5	5 el. conversion kit	99.95	79.95	203	3 el. 2M beam	15.95	
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- **Month and Year to Date Merge**—This program will take your monthly ledger data and give you a year to date ledger.
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For the TRS-80 Level I 4K. **Order No. 0061R $7.95.**

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- **Golf**—You won't need a mashie or putter—or a caddie, for that matter, to enjoy a challenging 18 holes.
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You'll need a TRS-80 Level I 4K, Level II 16K. **Order No. 0009R $7.95.**

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SPACE TREK II Protect the quadrant from the invading Klingon warships. The Enterprise is equipped with phasers, photon torpedoes, impulse power, and warp drive. It's you alone and your TRS-80 Level I 4K, Level II 16K against the enemy. **Order No. 0002R $7.95.**

CAVE EXPLORING/YACHT/CONCENTRATION These three programs are not only fun, but stimulating as well:

- **Cave Exploring**—Search for fabulous treasures as you explore the magic cave. For one player.
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- **Concentration**—Two players can pit their memories in this program based on the popular television show.

You'll need a TRS-80 with Level I and 16K. **Order No. 0010R $7.95.**

OIL TYCOON Avoid oil spills, blowouts and dry wells as you battle to become the world's richest oil tycoon. Two players become the owners of competing oil companies as they search for oil and control their companies. Requires a TRS-80 4K Level I & II. **Order No. 0023R $7.95.**

HEX PAWN/SHUTTLE CRAFT DOCKING/SPACE CHASE/BATTLESHIP This four-game package is sure to provide hours of fun for the whole family.

- **Hex Pawn**—Turn your TRS-80 into a model of artificial intelligence by playing a simple game.
- **Shuttle Craft Docking**—Land your shuttle craft on the starship—even through varying gravity fields!
- **Space Chase**—Seek out and destroy the enemy delta that's hidden in the star field.
- **Battleship**—You must find and destroy the enemy fleet.

This package requires a TRS-80 Level I 16K. **Order No. 0041R $7.95.**

SANTA PARAVIA AND FIUMACCIO Become the ruler of a medieval city-state as you struggle to create a kingdom. Up to six players can compete to see who will become the King or Queen first. This program requires a TRS-80 Level I & II. **Order No. 0043R $7.95.**

CARDS This one-player package will let you play cards with your TRS-80—talk about a poker face!

- **Draw and Stud Poker**—These two programs will keep your game sharp.
- **No-Trump Bridge**—Play this popular game with your computer and develop your strategy.

This package's name says it all. Requires a TRS-80 Level II 16K. **Order No. 0063R $7.95.**

PERSONAL FINANCE I Let your TRS-80 handle all the tedious details the next time you figure your finances:

- **Personal Finance I**—With this program you can control your incoming and outgoing expenses.
- **Checkbook**—Your TRS-80 can balance your checkbook and keep a detailed list of expenses for tax time.

This handy financial control for the home requires only a TRS-80 Level I 4K. **Order No. 0027R $7.95.**

BOWLING Let your TRS-80 set up the pins and keep score. One player can pick up spares and get strikes. For the TRS-80 Level I 4K, Level II 16K. **Order No. 0033R $7.95.**

BACKGAMMON/KENO Why sit alone when you can play these fascinating games with your TRS-80?

- **Backgammon**—Play against the computer. Your TRS-80 will give you a steady challenging game that's sure to sharpen your skills.
- **Keno**—Enjoy this popular Las Vegas gambling game. Guess the right numbers and win big.

You'll need a TRS-80 Level I & II. **Order No. 0004R $7.95.**

ELECTRONICS I This package will not only calculate the component values for you, but will also draw a schematic diagram, too. You'll need a TRS-80 Level I 4K, Level II 16K to use:

- **Tuned Circuits and Coil Winding**—Design tuned circuits without resorting to cumbersome tables and calculations.
- **555 Timer Circuits**—Quickly design astable or monostable timing circuits using this popular IC.
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This package will reduce your designing time and let you build those circuits fast. **Order No. 0006R $7.95.**

DESTROY ALL SUBS/GUNBOATS/BOMBER This package of three programs is fun for the whole family. Included are:

- **Destroy All Subs**—Hunt down enemy subs while avoiding mines and torpedoes. A one-player game.
- **Gunboats**—One or two players can try to blow each other's ships out of the water.
- **Bomber**—Carefully release your bomb to destroy the moving submarine. A one-player game.

To enjoy these programs, you'll need a TRS-80 Level I 4K. **Order No. 0021 R $7.95.**

KNIGHT'S QUEST/ROBOT CHASE/HORSE RACE This varied package of one-player games will give you hours of fun.

- **Knight's Quest**—Battle demons to gain treasure and become a full-fledged knight.
- **Robot Chase**—Destroy the deadly robots without electrocuting yourself.
- **Horse Race**—Place your bet and cheer your horse to the finish line.

These programs require a TRS-80 Level I 16K. **Order No. 0003R $7.95.**

SPACE TREK III Let yourself go to the far ends of the solar system—and beyond. This package includes:

- **Stellar Wars**—Shoot down the Tie fighters and destroy the Death Star.
- **Planetary Lander**—Land your spacecraft and plant your flag across the solar system.

These one-player games require a TRS-80 Level I 4K. **Order No. 0031R $7.95.**

SPACE TREK IV Trade or wage war on a planetary scale. This package includes:

- **Stellar Wars**—Engage and destroy Tie fighters in your attack on the Death Star. For one player.
- **Population Simulation**—A two-player game where you control the economy of two neighboring planets.

You decide, guns or butter, with your TRS-80 Level II 16K. **Order No. 0034R $7.95.**

CAR RACE/RAT TRAP/ANTIAIRCRAFT Enjoy these challenging, fun-filled programs:

- **Car Race**—You and a friend can race on a choice of two tracks.
- **Rat Trap**—Trap the rat in his maze with your two cats. For one player.
- **Antiaircraft**—Aim and shoot down the enemy airplane. Requires Level I 4K TRS-80. **Order No. 0011R $7.95.**

STATUS OF HOMES/AUTO EXPENSES Two long-awaited programs that have got to save you money at work or in the home:

- **Status of Homes**—This program will allow you to keep track of all the expenses involved in building one house or an entire subdivision.
- **Auto Expenses**—Find out *exactly* what it costs you to drive your car or truck.

These programs require a TRS-80 Level I 4K. **Order No. 0012R $7.95.**

(TRS-80 continued)

BOWLING LEAGUE STATISTICS SYSTEM This package is the answer to the prayers of harried bowling league scorekeepers. The Bowling League Statistics System will keep a computerized list of league data, team data, and data for each bowler. It is extremely flexible and has a total of 16 different options to let you modify the program to suit your league's rules. The program is very easy to use and has extensive "built in" aids to help you along. Requires TRS-80 Level II 16K. **Order No. 0056R $24.95.**

DEMO I This package is just the thing to show your friends what your TRS-80 can do. Included are:

- **Computer Composer**—Compose and play music using only a standard AM radio.
- **Baseball**—Play baseball with your computer while it does the scorekeeping.
- **Horse Race**—Place your bet and cheer your pony to the winner's circle.
- **ESP**—Test your powers of extrasensory perception.
- **HI-Lo/Tic-tac-toe**—Guess the secret number or get three in a row.
- **Petals Around the Rose**—Can you figure out the secret behind the five dice?
- **Slot Machine**—Turn your computer into a one-armed bandit. These programs require a TRS-80 Level I 4K. **Order No. 0020R $7.95.**

for the PET*

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DOW JONES Up to six players can enjoy this exciting stock market game. You can buy and sell stock in response to changing market conditions. Get a taste of what playing the market is all about. Requires a PET with 8K. **Order No. 0026P $7.95.**

QUBIC-4/GO-MOKU Play two ancient games on your modern PET. The two programs included are:

- **Qubic-4**—Play a multi-dimensioned game of tic-tac-toe.
- **Go-Moku**—Line up five of your men while blocking the PET's moves.

These one player games require 8K of memory. **Order No. 0038P $7.95.**

TREK-X Command the Enterprise as you scour the quadrant for enemy warships. This package not only has superb graphics, but also includes programming for optional sound effects. A one-player game for the PET 8K. **Order No. 0032P $7.95.**

PERSONAL WEIGHT CONTROL/BIORHYTHMS Let your PET help take care of your personal health and safety:

- **Personal Weight Control**—Your PET will not only calculate your ideal weight, but also offer a detailed diet to help control your caloric intake.
- **Biorhythms**—Find out where your critical days are for physical, emotional, and intellectual cycles.

You'll need only a PET with 8K memory. **Order No. 0005P $7.95.**

TANGLE/SUPERTRAP These two programs require fast reflexes, and a good eye for angles:

- **Tangle**—Make your opponent crash his line into an obstacle.
- **Supertrap**—This program is an advanced version of Tangle with many user control options.

Enjoy these exciting and graphically beautiful programs. For one or two players with an 8K PET. **Order No. 0029P $7.95.**

MORTGAGE WITH PREPAYMENT OPTION/FINANCIER These two programs will more than pay for themselves if you mortgage a home or make investments:

- **Mortgage with Prepayment Option**—Calculate mortgage payment schedules and save money with prepayments.
- **Financier**—Calculate which investment will pay you the most, figure annual depreciation, and compute the cost of borrowing, *easily and quickly*.

All you need to become a financial wizard with an 8K PET. **Order No. 0006P $7.95.**

PENNY ARCADE Enjoy this fun-filled package that's as much fun as a real penny arcade—at a fraction of the cost!

- **Poetry**—Compose free verse poetry on your computer.
- **Trap**—Control two moving lines at once and test your coordination.
- **Poker**—Play five card draw poker and let your PET deal and keep score.
- **Solitaire**—Don't bother to deal, let your PET handle the cards in this "old favorite" card game.
- **Eat-'Em-Ups**—Find out how many stars your gobbler can eat up before the game is over.

These six programs require the PET with 8K. **Order No. 0044P $7.95.**

CASINO I These two programs are so good, you can use them to check out and debug your own gambling system!

- **Roulette**—Pick your number and place your bet with the computer version of this casino game. For one player.
- **Blackjack**—Try out this version of the popular card game before you go out and risk your money on your own "surefire" system. For one player.

This package requires a PET with 8K. **Order No. 0014P $7.95.**

MIMIC Test your memory and reflexes with the five different versions of this game. You must match the sequence and location of signals displayed by your PET. This one-player program includes optional sound effects with the PET 8K. **Order No. 0039P $7.95.**

BASEBALL MANAGER This pair of programs will let you keep statistics on each of your players. Obtain batting, on-base, and fielding averages at the touch of a finger. Data can be easily stored on cassette tape for later comparison. All you need is a PET with 8K. **Order No. 0062P $14.95.**

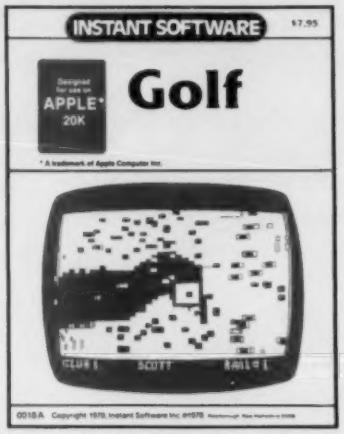
CHECKERS/BACARRAT Play two old favorites with your PET.

- **Checkers**—Let your PET be your ever-ready opponent in this computer-based checkers program.
- **Bacarrat**—You have both Casino and Blackjack-style games in this realistic program.

Your PET with 8K will offer challenging play anytime you want. **Order No. 0022P $7.95.**

CASINO II This craps program is so good, it's the next best thing to being in Las Vegas or Atlantic City. It will not only play the game with you, but also will teach you how to play the odds and make the best bets. A one player game, it requires a PET 8K. **Order No. 0015P $7.95.**

for the Apple***



GOLF Without leaving the comfort of your chair, you can enjoy a computerized 18 holes of golf with a complete choice of clubs and shooting angles. You need never cancel this game because of rain. One or two players can enjoy this game on the Apple with Applesoft II and 20K. **Order No. 0018A $7.95.**

BOWLING/TRILOGY Enjoy two of America's favorite games transformed into programs for your Apple:

- **Bowling**—Up to four players can bowl while the Apple sets up the pins and keeps score. Requires Applesoft II.
- **Trilogy**—This program can be anything from a simple game of tic-tac-toe to an exercise in deductive logic. For one player.

This fun-filled package requires an Apple with 20K. **Order No. 0040A $7.95.**

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How often have you been driving along monitoring your favorite frequency and heard someone with a familiar callsign, but you just couldn't remember the name that went with it? And if they gave you a call, they always threw your name in along with your call, of course. Sometimes it seems like a deliberate challenge designed to see if you can come back with the right name. Wouldn't it be nice if you could always respond with the name as well as the callsign the first time? Wouldn't it be even better if you could return a comment or ask a question about the fellow's hometown, favorite topic, or some other subject close to his heart?

Those of you with instant and total recall may be excused now. Described in this article is a recipe guaranteed to help the rest of us. Those of us, that is, who have either a computer or at least access to one. The two programs listed here are designed to provide the capability of storing, maintaining, and listing in alphanumeric order by callsign, the call, name, and telephone number (or city) of all the mobile contacts you've made and wish to remember. Along with all that information, there is also room for comments and remarks about anything, such as the special interests of each of those operators (e.g., RDF, DX, computers, flying, sailing, etc.).

The goal is to produce a list of stations worked by a mobile operator in a format that is convenient to use while driving (if that's possible). In order to be convenient, the list must be printed in alphanumeric order by callsign on standard-size paper (8.5 by 11 inches). The alphanumeric sequencing is obviously required if a call is to be found easily in any list. The notebook-size paper lends itself to use on a clipboard, often standard equipment for the mobile operator.

The BASIC programming language was chosen for the simple reason that BASIC is the most machine-independent language commonly used on both commercial and hobby computer systems. The particular version shown here uses video display terminal (VDT) cursor positioning control during the data entry and file maintenance functions. Also, the VDT "control keys" may be used as a shortcut to stopping the program or for bypassing the "change" function. More about these features later. If your system does not support these special features, the appropriate program statements may be easily modified without changing the logical operation of the programs. The only other statements that may need minor changes are the input/output statements (READ, WRITE, and PRINT) where, again, ad-

vantage was taken of the extensions available on my own particular system.

As written, the "file maintenance" program requires about 1K of memory, and the listing program needs about 700 bytes. Each data record consists of from 6 to 58 characters, depending upon how many actual characters were entered for each record. Even on systems that support only fixed-length records, a typical floppy disk will still have enough room to store well over a thousand different contacts. Remember, the idea is to produce a listing for mobile contacts, not your entire log.

The key to the whole operation is using a direct-access (also called a random-access) disk file with the callsign being used as the "key" to each record in the file. The file management part of the operating system software automatically keeps each record in the proper sequence by "sorting" the keys as each new record is added to the file. The keys are kept in one area of the disk and the rest of the data in each record is kept in another area contiguous to the first area. Both areas together comprise the whole data file.

Although there are several techniques used by different systems in handling direct-access data files, the result is basically the same. Each record may be retrieved directly without scanning the entire file looking for the particular record desired. This obviously saves a lot of time getting any specific record. At the same time, the fact that each record has its own unique key eliminates the possibility of duplicate records being stored in the same file. Still another advantage of direct-access files is the fact that no separate sorting of the records is required if the records are to be listed in order by their keys. By starting at the beginning of the file and reading it sequentially without specifying any key, all of the records in the file may be read and printed in alphanumeric order by callsign (key) automatically, since the file management system uses the keys area (usually called the "Directory") of the file to get to the physical records anyway.

File Maintenance

File maintenance simply means adding new records or changing or deleting old records in a data file. Program statements 0010 through 0502 in the file maintenance program define the names of the data items to be used in the program and OPEN the data file where all the records containing the information about the mobile contacts will be stored. Statements 100 through 1050 clear the VDT screen and display the heading information which indicates the name and description of the program being executed as well as the date. Each column of information is labeled with the appropriate name. The two-letter sets enclosed in apostrophes are special print control commands for output devices such as the printer and VDT. The CS means "Clear Screen" and is valid only for the VDT. LF means "Line Feed" and causes a blank line to be printed on the printer or displayed on the VDT.

Many computer terminals have special keys called "function keys" or "control keys." These keys may be used as a shortcut method of indicating specific actions to be taken by a program if that program has the ability to interpret them when they are used by the terminal operator. Since this program allows the operator to use these special keys, the actual functions that some of them are programmed for are also displayed when the program begins.

Program statements 2000 through 2440 handle the actual data entry portion of the file maintenance function. Each of the four data items is entered separately, and each is terminated by pressing the carriage return key (CR). The variable (data item) named "F$" was initially defined in statement 0070 to be a string of 30 characters. A very special character ("Control-Period" on my terminal) was included in the DIMension statement for F$ between the quotation marks following the size specified for that data item. This special character does not exist on the printer used to list the program, but it does appear on the VDT screen and looks like the cursor, which, on my own terminal, is a solid-looking block that entirely fills one character position. Actually, this is an "inverted period," but the dot representing the period is so small, it's almost invisible. Several of these characters displayed together look like one long, continuous cursor. Although entirely unnecessary, this little trick enhances the aesthetic quality of the display and emphasizes the particular data field be-

```
0010 REM "HRMLFM".HAM.RADIO.MOBILE.LOG.FILE.MAINTENANCE.
0020 BEGIN
0060 DIM C$(6),N$(10),P$(8),R$(30)
0070 DIM F$(30," "),F$(30,"▪")
0080 IOLIST C$,N$,P$,R$
0502 OPEN (2)"HRF2"
1000 REM
1010 PRINT 'CS',"HRMLFM",@(10,1),"HAM RADIO MOBILE LOG FILE MAINTENANC
1010:E",@(50,0),DAY
1030 PRINT 'LF','LF'," CALL     NAME      TELEPHONE  INTERESTS, HOBBIES,
1030: & REMARKS"
1040 PRINT "------- ---------- --------- ------------------------------
1040:"
1050 PRINT @(64,0),"CONTROL-KEYS:",@(66,1)," I = CR",@(66,2),"II = NO
1050:'",@(66,3),"IV = 'END'"
2000 REM
2010 LET L=5
2020 PRINT @(0,5),'LD','LD','LD','LD','LD','LD','LD','LD','LD','LD','L
2020:D','LD','LD','LD','LD','LD','LD','LD','LD','LD','RB'
2100 PRINT @(0,L),F$(1,6)," ",'RB',
2110 INPUT @(0,L),C$
2120 IF (C$="END")OR(CTL=4)GOTO9000
2130 IF (LEN(C$)=6)GOTO3000
2140 IF (LEN(C$)>6)GOTO2100
2150 LET C$=C$(1,LEN(C$))+$$(1,(6-LEN(C$)))
2160 GOTO 3000
2199 REM ------------------------------
2200 PRINT @(7,L),F$(1,10)," ",
2210 INPUT @(7,L),N$
2211 IF (CTL>1)OR(N$="▪")GOTO4030
2215 IF (N$="DELETE")GOTO6000
2220 IF (LEN(N$)<11)GOTO2300
2230 PRINT @(7,L),'RB',
2240 GOTO 2200
2299 REM ------------------------------
2300 PRINT @(18,L),P$(1,8)," ",
2310 INPUT @(18,L),P$
2320 IF (LEN(P$)<9)GOTO2400
2330 PRINT @(18,L),'RB',
2340 GOTO 2300
2399 REM ------------------------------
2400 PRINT @(28,L),R$,
2410 INPUT @(28,L),R$
2420 IF (LEN(R$)<31)GOTO4000
2430 PRINT @(28,L),'RB',
2440 GOTO 2400
3000 REM ------------------------------
3010 READ (2,KEY=C$(1,6),DOM=2200)IOL=80
3020 GOTO 5000
4000 REM ------------------------------
4010 WRITE (2,KEY=C$(1,6))IOL=80
4020 LET L=L+1
4030 IF (L<21)GOTO2100
4040 GOTO 2010
5000 REM ------------------------------
5010 PRINT @(0,L),C$,@(7,L),N$,@(18,L),P$,@(28,L),R$
5020 LET L=L+1
5030 PRINT @(0,L),C$
5040 GOTO 2200
6000 REM ------------------------------
6010 REMOVE (2,KEY=C$,DOM=6020)
6020 PRINT @(40,L-1),"DELETED",'RB'
6030 PRINT @(0,L),'CL',
6040 GOTO 2100
9000 REM ------------------------------
9010 CLOSE (2)
9020 PRINT 'LF','RB',"DO YOU WANT A NEW LISTING NOW?: ",
9030 INPUT C$
9040 IF (C$="YES")OR(C$="Y")RUN"HRMLAL"
9800 PRINT 'LF','RB',"FINISHED...",
9999 END
```

Fig. 1. Program listing—file maintenance.

```
0010 REM "HAMLAL".HAM.RADIO.MOBILE.LOG.ALPHABETICAL.LISTING.
0020 BEGIN
0030 PRINT 'CS',"HAMLAL",@(25,0),"HAM RADIO MOBILE LOG/LIST",@(70,0),D
0030:AY
0060 DIM C$(6),N$(10),P$(8),R$(30),K$(6)
0080 IOLIST C$,N$,P$,R$
0500 IF (C$(1,3)<>K$(1,3))AND(L>1)PRINT(5)""
0520 OPEN (2)"HBF2"
0550 OPEN (5)"LP"
0600 LET H=1,P=1
1000 REM ------------------------------------------------------------------
1010 PRINT (5)'FF','EP',"WB5UTJ MOBILE QSO LIST  ",DAY,'LP'
1030 PRINT (5)" CALL     NAME      TELEPHONE    INTERESTS,HOBBIES, & REM
1030:ARKS          PAGE",P
1040 PRINT (5)"-------- ---------- --------- --------------------------
1040:-------"
1100 LET L=1
2000 REM ------------------------------------------------------------------
2010 READ (2,END=9800)IOL=80
5000 IF (C$(1,3)<>K$(1,3))AND(L>1)PRINT(5)""
5010 PRINT (5)C$(1,3)," ",C$(4,3),@(8),N$,@(19),P$,@(29),R$,@(61),H
5020 LET K$=C$
5100 LET L=L+1,H=H+1
5110 IF (L<51)GOTO2000
5120 LET P=P+1
5130 GOTO 1000
9800 PRINT (5)'LP','EP',"QRT"
9999 END
```

Fig. 2. Program listing—alphabetical listing.

ing requested by the program.

The first thing the program requests is a callsign. When a call is entered, the program verifies that the call does not exceed six characters in length (the maximum size defined for the keys in the data file). If too many characters are entered, the program rejects the entry and requests the callsign again. Each time a call is requested, the VDT audible "beep" signal is sounded by the RB command included in statement 2100. RB means "Ring Bell," and, even though that name came originally from the older teletypewriters which actually did have a bell inside, the name stuck and is used to indicate the "beep" signal used on most video-type terminals.

I might mention, by the way, that, even though this program is intended for use with a video terminal, it will run on hard-copy terminals if the statements containing "F$" are simply removed.

WB5UTJ MOBILE QSO LIST 02/13/78

CALL	NAME	TELEPHONE	REMARKS	PAGE 1
K5 ANW	CHARLES		RDF, COMPUTERS, (DP FORMS SLS)	1
K5 FOO	JOE	461-7505	RACES, RDF, ARLINGTON RADIO CLUB	2
K5 IHD	DON	292-4703	TRSUR OF WRSAER, 4709 CARLYLE	3
K5 IID	TOM		FOREST HILL	4
K5 IIL	KEN RIDOUT	271-3925	NOVICE TEST, SAILPLANE OWNER	5
K5 JLB	AL		COPERAS COVE, TX	6
K5 KGR	MIKE GUSKY	271-3826	FLYING, COMPUTERS	7
K5 RMZ	CHARLIE	297-9210	SHOP, 926-1869, DX, SS, RACES	8
K5 TER	DON	634-9810	(OFFICE #)	9
K5 YL	RUTH	267-0407	TOM(K5YM)	10
K5 YM	TOM CHANCE	267-0407	RUTH(K5YL), EX-WA5VJX, ARRL OFCR	11
N5 DK	DICK		ARLINGTON, (AA PILOT)	12
N5 TK	BOB		EX-WB5TEA	13
N5 UN	GARY	834-8413	EX-K5BVJ, DX, (TV STN)	14
W5 DIF	BILL		CONFEDERATE AIR FORCE	15
W5 FL	WEN	498-0240	DX, RACES, (DESIGN ENGR)	16
W5 GES	ED	267-4089	RDF, NAVYMARS, RMT CTL, AIRCRAFT	17
W5 HAF	MACK	589-2619	RDF, NAVYMARS, RACES, COFFEE	18
W5 JDL	PAPPY		OWNS OAK GROVE AIRPORT	19
W5 OFN	BILL	926-3113	KC CLUB, RACES	20
W5 TAW	ADRIAN	283-0052	COMPUTERS, (BUILDER)	21
W5 TI	BILL	737-7891	FIELD DAY STN OF KC CLUB, RACES	22
W5 UXP	EDDIE	451-6100	RACES ORCR, RDF, P-51, (INSUR)	23
W7 ERH	JOEL		COMPUTERS, 22/82, (MOSTEK)	24
W8 BIB	JONATHAN		SAN ANTONIO, TX, (DATAPOINT)	25
W8 TIF	KARL	238-0773	COMPUTERS, 22/82	26
WA4 IXN	"WOLF"	284-9794	OWNS A SCORPION-2, RACES, (FWPD)	27
WA5 AKD	ED	429-0596	NEIGHBOR, ARMYMARS	28
WA5 JCQ	JEAN	924-7990	RACES, KC CLUB TREASURER	29
WA5 JFO	JESSIE	267-7386	(RAILROAD)	30
WA5 MHW	TRACY	293-2275	RACES, (ELECTRONICS RETAILER)	31
WA5 QPZ	DUDLEY	499-3804	HOUSTON, TX (OA COMPUTERS)	32
WA5 UBY	FRED		(ARLINGTON ELECTRONICS)	33
WA5 UVU	DON	838-0275	RDF, RACES, (DEPUTY SHERRIF)	34
WB5 CPO	BILL		COMPUTERS, DX, (ARL ELECTRONICS)	35
WB5 DMR	BETTY	268-2666	RACES OFFICER, KC CLUB	36
WB5 FIV	JERRY		AGGIE	37
WB5 FLQ	CLAUDE	923-4400	RACES, FISHING(WHITNEY), SAILING	38
WB5 FPI	ED (VELON)	293-0565	429-7200, (KNOK), RDF, CNTRL OPR	39
WB5 HFH	BEN	624-8978	RACES OFFICER, CD OFF. 335-5754	40
WB5 KCK	ROGER	478-5819	JEAN(WB5UIV), RACES, KCC OFCR	41
WB5 KUB	DALE	748-6601	BICYCLING, SPORTS, GE PROG, (CPA)	42
WB5 NXS	DENNIS	485-2196	RDF, NAVYMARS, RACES, COFFEE	43
WB5 OMR	BOB		NEIGHBOR, ANTENNAS, DX, COMPUTERS	44
WB5 PXF	CHERYL	232-1530	JACK(WB5PYO), RDF, KCC MAIL LIST	45
WB5 PYO	JACK	232-1530	CHERYL(WB5PXF), RDF, RACES	46
WB5 RFA	GARY	478-8470	COMPUTERS, UHF, VHF, CB, RDF, RACES	47
WB5 TQJ	DAVE	460-8627	RACES, NAVYMARS, (ARLINGTON PD)	48
WB5 IPN	JIM	268-5550	RDF, NAVYMARS, AGGIE, (USED CARS)	49

Fig. 3. Sample run of the mobile QSO list.

Automatic Mode Change

When a valid callsign is entered (actually, any six characters will be accepted), the program immediately checks the data file to see if that callsign had been entered previously. If it is a new call, the next data field is "lit up" (or underscored, if your terminal uses the underscore character for a cursor) and a name can be entered. The next field may be used for either a telephone number or city name, and the last field may be used for any comments you may want to remember about that particular operator. Each new line entered remains on the screen until 20 lines have been entered, at which time statement 2020 sends 20 "Line Delete" (LD) commands to the VDT at row 0, line 5, causing the last 20 lines entered on the screen to be "scrolled" up and out of sight. This prevents the heading information at the top of the screen from being lost after the last line on the screen has been used, since most VDTs automatically scroll all the lines up one line each time the last line is used.

The process continues until a call is entered that is already "on file." When this happens, the information previously entered for that operator is displayed under the appropriate column headings. The callsign is then displayed again on the next line down and the program requests something to be entered in the "name" field. If the information displayed on the previous line is correct as is, you can simply press the "Control-II" key, and the computer will leave that record unchanged and request another callsign. If your terminal doesn't have function keys, the program will accept a single asterisk (*) as the indication that the record displayed is not to be changed. If, however, you do wish to change anything in that record, simply reenter each of the three remaining data items as they appear in the line above, making the changes as desired. Upon receipt of the last item, the old record is replaced by the new information and another callsign is requested. Simple.

If you wish to completely delete any particular callsign from the file, just enter the callsign. When that record is found and displayed on the screen, enter the word "DELETE" in the name field. The program will remove that record completely from the data file and display the word "DELETED" by that line on the screen (statements 6000 through 6040), and then request another callsign.

Typing the word "END" (or hitting the "Control-IV" key) when the program is requesting a callsign will terminate the file maintenance program. Before it stops, however, it will ask if you want a new list to be printed immediately. If you enter "YES" or "Y", the second program will be executed automatically, saving you the trouble of having to run it yourself. This allows you to enter several new contacts or make a few changes as convenient, without actually producing a complete new listing each time you run the maintenance program.

Printing the List

The second program may be run separately whenever an updated listing is desired, as well as automatically at the end of the file maintenance pro-

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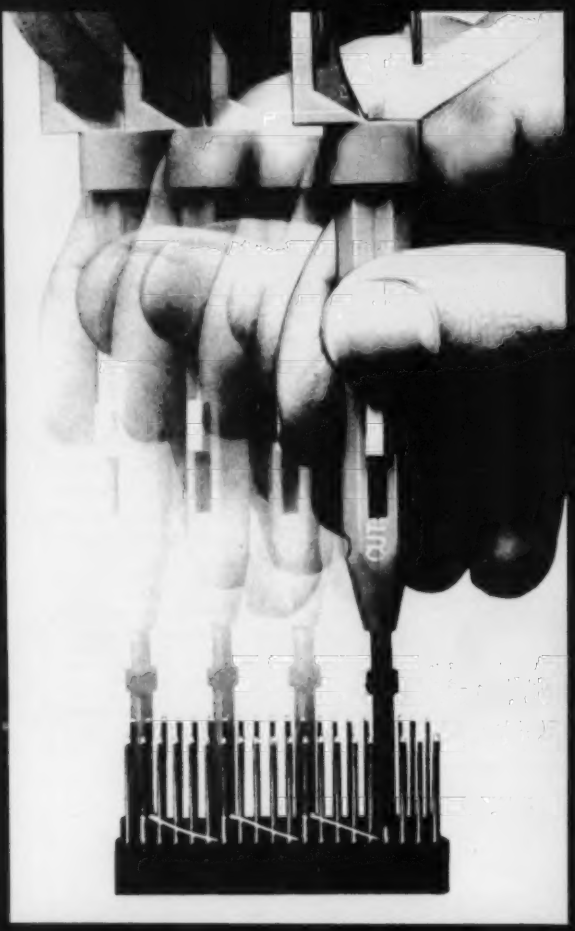

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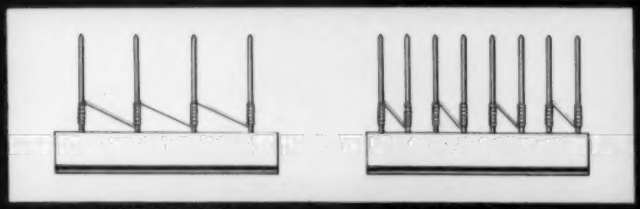

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gram. Having two separate programs keeps the amount of memory required to a minimum. The listing program simply READs the previously described data file sequentially by callsign (key) and prints the information stored in each record in a format I have tried and found to be most convenient to use while operating mobile. As previously mentioned, each record is automatically stored in alphanumeric sequence by the file management system. Thus, no separate sorting of the records is required. Each record is read sequentially and printed in callsign order.

It is possible (and actually quite easy) to have the program rearrange each callsign in such a way that the sorting order is the same as that used in the *Callbook*—that is, all calls in the same call area listed together. However, this method did not seem to have any advantage for the mobile operator who needs to locate a specific call quickly and easily. Although I would not want to see the *Callbook* listed this way, it does speed up the search if you include the call area in the prefix and keep all the Ks, Ws, WBs, etc., together in this kind of list. I also found that printing a space between the prefix and suffix of each callsign greatly improved the readability of the list. Still further improvement was obtained by leaving a blank line between each different prefix group. The listing program simply skips a line whenever there is any difference between the first three characters of the next callsign to be printed and the first three characters of the last callsign printed. The combination of separating the prefixes and the suffixes and leaving a blank line between each different group makes it extremely easy to locate a particular call quickly (assuming, of course, that the call is in the list).

You will probably notice from the prefixes and some of the remarks in the sample listing that it was compiled from contacts in the Dallas-Fort Worth "metroplex" area. Certainly there are no restrictions on how the list is used. If I had been equipped to operate 75 or 40 meter mobile, I think the list would have been even more valuable.

There are always tradeoffs to be considered when writing new programs. One touch of laziness must be admitted here. I did not bother to do any "processing" of the callsigns, except to ensure that none were longer than six characters in length. I also chose to manually enter a blank at the beginning of all 1 × 2 and 1 × 3 calls in order that those would be listed in the "proper" sequence. This could have been taken care of by the program, but the extra program steps did not seem justified based on the fact that it is so simple and easy to just enter the blank when entering such a call.

The listing program prints 50 calls on each page and puts a sequence number on each line down the right-hand side of the listing. Since the printer I use has the ability to produce "Expanded Print" (EP) for any specified line, I used this feature to print the heading line at the top of each page. Each of the four data columns is labeled, of course, and each page is consecutively numbered. If you don't have a separate printer on your system, you can easily change the listing program to print the list on your terminal if it is the hard-copy type. ■

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01	33	STO	Stores current odo reading in R4 for use later in
02	04	4	calculation.
03	84	R/S	KEY IN current time in format HH.MMSS.
04	33	STO	Stores current time
05	02	2	in R2.
06	34	RCL	Recalls starting time and subtracts it from
07	01	1	current time to determine time since trip
08	32	g	began, still in format HH.MMSS.
09	41	H.MS-	
10	31	f	Converts time since trip began to
11	01	H←	decimal hours.
12	33	STO	Stores this in R5.
13	05	5	
14	34	RCL	Recalls accumulated time out
15	06	6	from R6,
16	31	f	converts it to decimal hours, and
17	01	H←	subtracts it from time
18	51	-	since trip began.
19	33	STO	Stores active driving time
20	05	5	in R5.
21	34	RCL	Recalls current odo reading from R4
22	04	4	and then
23	34	RCL	recalls beginning odo reading from
24	00	0	R0 and subtracts to get miles traveled.
25	51	-	
26	34	RCL	Recalls active driving time from R5 and
27	05	5	divides it into miles traveled
28	81	÷	to derive mph average.
29	33	STO	This is STOred in R7 for later recall
30	07	7	by hand if desired.
31	24	FIX	Fixes one decimal place (but by modifying
32	01	1	step 32, any number of places can be used).
33	-00	GTO00	Returns program to beginning.

At Start of Trip:

A. STOre starting time in format HH.MMSS in R1.

B. STOre base odometer reading in R0. For cars with a trip odo, this can be left as 00.00, or car's accumulated odo can be used.

During Trip:

C. If you want mph averages based only on driving time, add each rest stop in format HH.MMSS to R6. (RCL 6, KEY IN latest time out, f, H.MS+, STO 6.) Ignore this step if you want overall average mph regardless of stops.

D. To calculate current average mph, KEY IN current odo reading and punch R/S. Then KEY IN current time (HH.MMSS) and punch R/S again. OUTPUT will be average mph attained.

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External operation, internal charge.

The Wilson WE-800 is a versatile, synthesized two meter FM portable transceiver. It operates from an external 13.8-volt source or internal nicad batteries with the mere flip of a switch on the rear apron. Unfortunately, there is no provision for charging the nicads while operating from external power. Anticipating that this would be a useful feature, I immediately went to the books to find a suitable constant-current charging circuit.

Experiments were run using a series current-limiting resistor while charging the nicads from a 13.8-volt regulated power supply. Various resistances ranging from 10 to 36 Ohms were tried, but in every case the starting current was either much too high (100 mA plus) or it dropped off rapidly to well under 50 mA within the 16-hour charging period. (My GE nicads specify a charging rate of 40-50 mA for 16 hours.) Experiments with various pilot lamps in place of the resistor yielded much less variation between the starting and fully-charged currents. Either a 47 or a 1847 bulb (6.3 V, 150 mA) produced charging currents in the 50-mA range. I found that individual batteries, even new ones of the same make, may affect the charging rate and it is wise, therefore, to substitute batteries and monitor the charging rate during the experimental period.

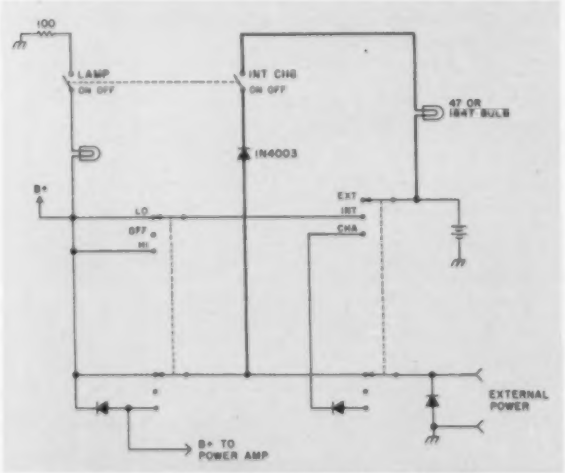

Fig. 1. The new circuit is shown in bold.

Fig. 1 shows the final charging circuit. The 1N4003 diode prevents current flow from the nicads to the external power source. The dial light on-off switch is used also to turn the internal charging circuit on and off. Just remove the existing wires from one side of this switch and use that side to control the charging function. Nicad memory dictates that the batteries should be fully discharged before full recharging, and this switch allows controlled charging. With the circuitry shown, the nicads charge if the charge switch is on, even if the rig's power switch is turned off. When the power switch is turned off, the nicad charging current can be read directly with a milliammeter in line to the external power socket.

The charging current to discharged nicads starts at approximately 75 mA and drops slowly to approximately 50 mA over four hours. This rate holds for the remaining 12 hours. Very similar results are obtained in the car, but there is reduced charging current until the engine and alternator are running. This is because the charging current is determined by the relative voltage of the charger and chargee.

Incidentally, the Wilson WE-800 Owner's Manual does not contain a caution against charging the nicads directly from a regulated power supply, and it probably should. A charging current well in excess of 150 mA was measured with this direct hookup.

With the modified WE-800, I can operate two meters at home or in the car while the nicads are simultaneously charging. With a little imagination, similar circuitry could be installed in almost any nicad-equipped rig. ■

References

Arvid G. Evans K7HKL, "Regulated Nicad Charger," *73 Magazine*, June, 1977, p. 117.

Hank Olson W6GXN, "Battery Chargers Exposed," *73 Magazine*, November, 1976, p. 98.

The Radio Amateur's Handbook, 1978 edition, p. 134.

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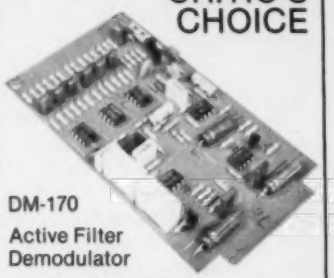

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Where Have All the kHz Gone?

—are ham bands an endangered species?

Prophets of doom vs. masters of deceit.

Paradise lost; that could be the story of our beloved old 40 meter band. What fun we had! If we wanted to work Australia, we looked from 8000 to 9000 kHz, Europe was from 6000 to 7000 kHz, and the USA hams had 7000 to 8000 kHz exclusively to roam around in. We never heard of intruders, and all was beer and skittles until the ARRL started to "preserve" our bands.

Let's take a graphic look (Figs. 1 and 2) at our workhorse bands that were admittedly preserved by the ARRL. They very graciously (and with great publicity) provided the sum of $100,000 to protect bands that were worth a king's ransom, bands so valuable even today that you cannot put a price on them.

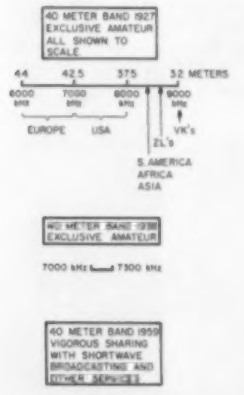

Fig. 1.

Pretty gruesome, isn't it? But that "ain't" the total story. When shortwave stations began to appear in our bands, our vigilant ARRL, with great poise and indignation, coined the word "intruder" and established the intruder watch. The purpose of this is to enable you to let off steam and have you think that something is being done about the problem. This intruder watch is a real exercise in frustration. So you report them, and years later they are still going merrily on their way. You know why? Because no one ever objected at the proper time to their being there. International law says that these frequencies are requested from and assigned in Geneva and, after assignment, other countries have a year to object to the allocation before it is final and the station goes on the air. After the station is on the air, it's too late.

This intruder thing may break our backs at WARC '79. Believe it or not, the dear broadcasters are now looking at *us* as intruders and want to throw *us* out! The extent of the intruders on 40 meters at night is horrendous and is rendering the band useless. Now you are begining to see them appear in daylight. At night, 40 is one mass of heterodynes and signals.

Have you ever wondered just how many stations are in there? *World Radio and TV* lists 414 stations all within 7000 to 7300 kHz. There are powers listed from 10 kW to 250 kW. Ninety percent of the powers are listed as 100 kW, 8% are listed as 250 kW, and 2% are over 50 kW. The Voice of America has 40 stations in this band, with powers of 100 kW to 250 kW. It's no wonder we hear a raft of intruders!

Our USA broadcasters took 100 kHz of our 160 meter band, and recent events indicate that they are going after more of this band. Other bands have gradually disappeared. Ham radio has been, and is, being piecemealed to death. After each WARC (and between some), we lose kilohertz and privileges. We are forced to develop new technology to cram more and more of us into a smaller and smaller space. It won't be long before we will have to develop "negative frequency." It's sad, and a sad commentary on our ability to preserve our bands.

Our dear ARRL writers have labeled men like me "prophets of doom." I have a name for them: "masters of deceit." ■

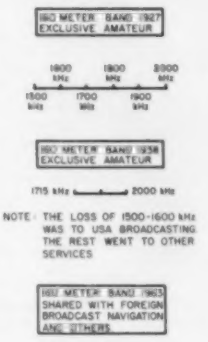

Fig. 2.

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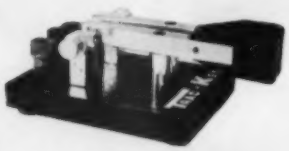

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The portability requirement ruled out any antenna scheme. While an amplifier seemed to be the only option left, a quick check of the catalog file showed that such units are available, but the prices just didn't agree with my tight budget, and the fact that my workbench was already cluttered with several unfinished projects ruled out homebrewing.

One day, as I was scanning the ads in my favorite magazine (*73*, of course), I saw it: the Ramsey Electronics PA-1. It's a two meter power amp kit which features 8 Watts out for one in, and as much as thirty out for four Watts in. The best part was the price. At $22.95, it looked like a real bargain. It looked *too* good to be true, however, so instead of running out and buying it, I promptly forgot about it.

A few months later, at the Wheaton, Illinois, hamfest, the Ramsey people had a sample PA-1 on display. At first I thought it wouldn't work—it was just too simple. However, the reduced hamfest price got rid of any fears I had left, and I bought it.

The heart of the amplifier is a Motorola VHF power amplifier transistor. Its hefty construction convinced me it could easily handle the claimed thirty Watts if properly heatsinked. Class C operation is used, so the unit is suitable for either CW or

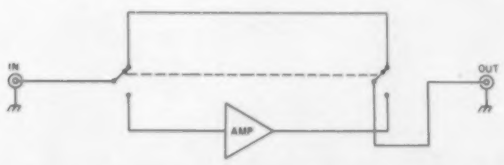

Fig. 1. A DPDT toggle switch or relay (see Fig. 2).

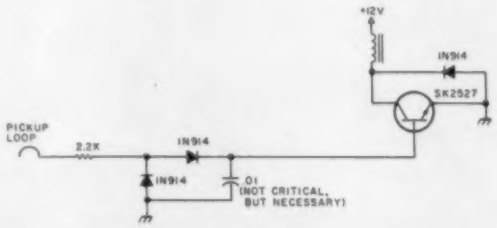

Fig. 2. Rf-sensing, relay-driver circuit.

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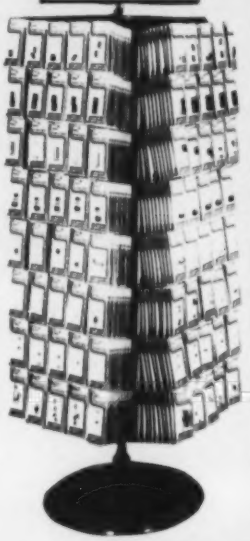

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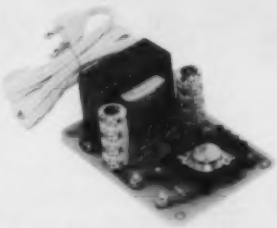

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FM operation. This also allows power consumption to drop to zero when receiving, so that battery life is extended in portable operation. Its wide input-to-output range makes it great for hooking up to rigs with different power output levels. Trimmer capacitors and a choke keep the unit running clean.

The instruction sheet takes only a few minutes to read. It is clear and to the point. Construction took me only two hours, but it could be done easily in half that time by a determined worker. The best part was the coil winding—it was over in less than five minutes. Soldering the transistor is the only critical step, and it is done last, so you have plenty of practice. I used plenty of heat-sink goop and made sure it was securely fastened to the chassis. The circuit board was the best I've seen in any kit; solder flowed on it with no problem. All parts were tack-soldered to one side of the board, so it helped to use plenty of heat.

Tune-up was as easy as construction. A wattmeter or some other measuring device is needed. The trimmers are adjusted for maximum output, and the amplifier is ready to go on the air. A check with a Bird wattmeter showed the amplifier output to be greater than nine Watts when driven by my TR-22C. The gain at that level is 8.9 dB, very close to the transistor spec-sheet 9-dB rating. Current drain was 1.2 Amperes, so efficiency was about 65%.

The kit comes with a circuit board and all the parts that go on it. No hardware, connectors, case, or switching circuitry are included. These can be obtained easily at an electronics supermarket if you don't already have them in your junk box. I bought a 5.25 x 3 x 2-inch aluminum minibox to house the circuit board and act as a heat sink. It is a bit larger than the board, so I have room for a receiver preamplifier or other additions at a later date. SO-239 connectors are mounted on either end of the box. I used the single-mounting-hole type, since they require less hardware and chassis work.

The instruction sheet includes a schematic for a T-R switching circuit. A DPDT relay is driven by a two-transistor sensing circuit. Since my junk box didn't have a relay that works on 12 volts, I decided to use a toggle switch instead. This simple approach, shown in Fig. 1, works well despite the inconvenience of having to flip a switch after every transmission. Later I was able to replace this cheapskate approach with a relay purchased from a surplus vendor. I simplified the suggested rf-sensing and relay-driver circuit by eliminating a transistor, two resistors, and a capacitor. A short length of hookup wire looped around the input line provides plenty of drive. The result, shown in Fig. 2, was wired on a small piece of perfboard which is glued to the relay case.

Someday my PA-1 will serve a second purpose as part of a simple exciter for OSCAR use. The PA-1 is one of several kits by Ramsey which I have built. All of them have met my expectations. The PA-1 has proven to be a real help in bringing up repeaters and in greatly improving my simplex range. Thanks to the PA-1, I can now compete with the big guns. ■

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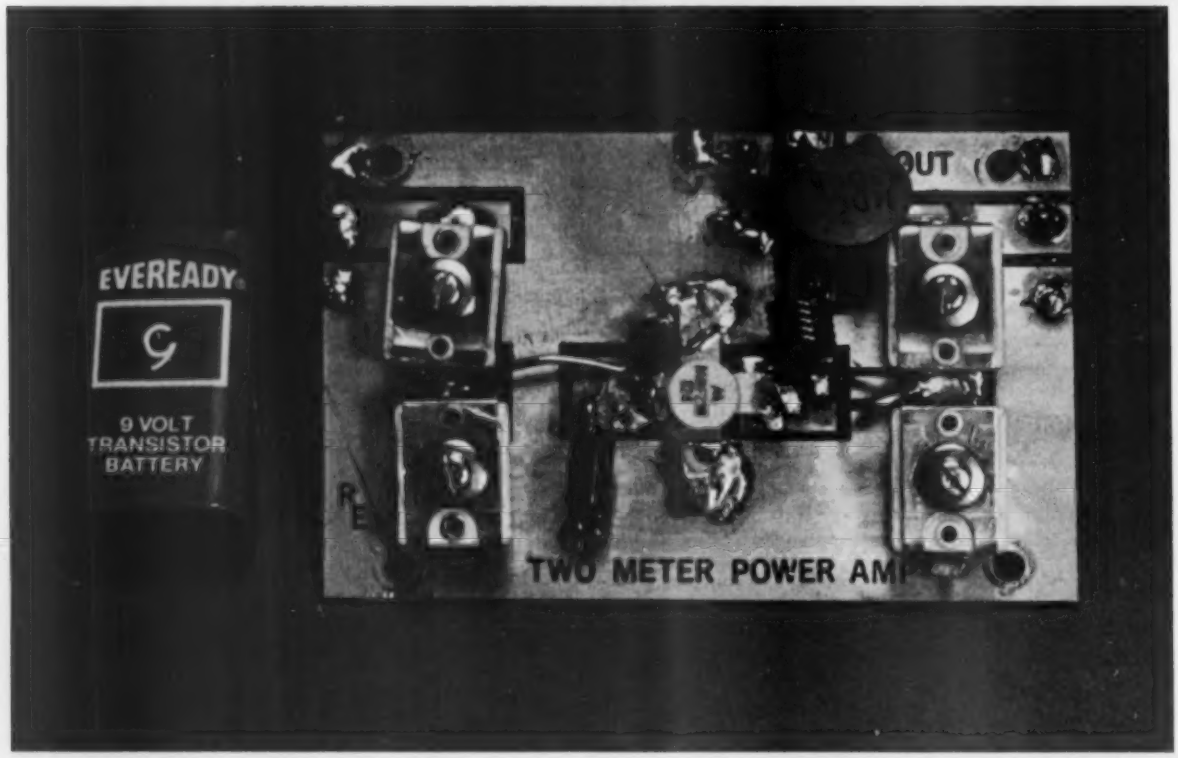

Ramsey Electronics' 30-Watt two meter power amplifier.

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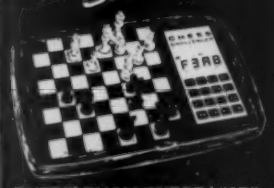

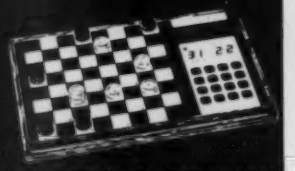

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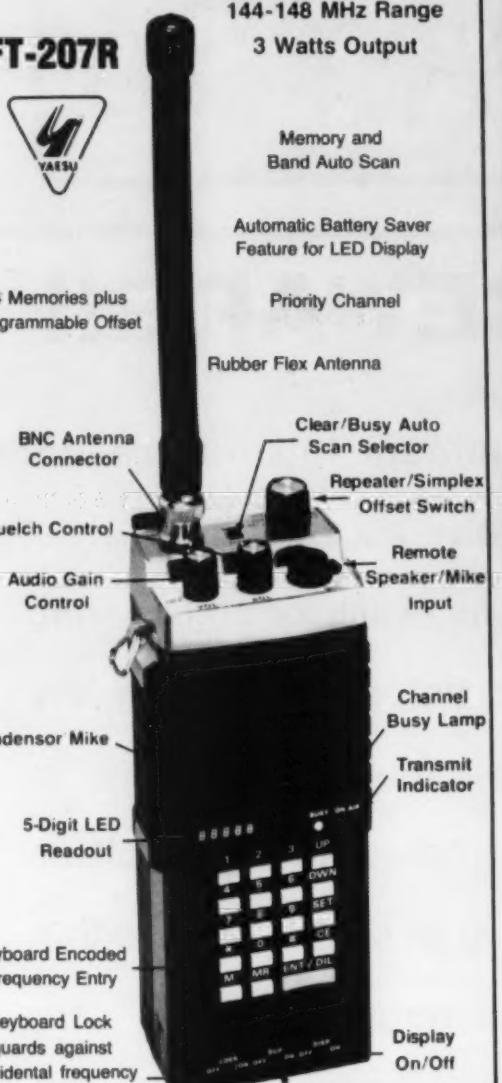

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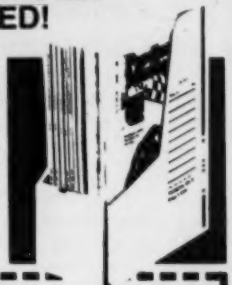

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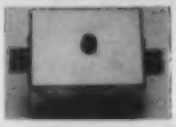

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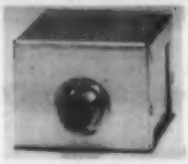

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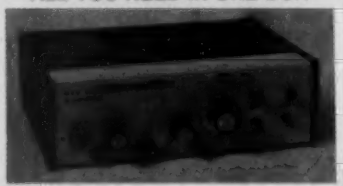

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—very sensible

Simple, fast, effective!

The Kenwood TR-7400A 2 meter FM transceiver is a fine radio, but it can be improved, operationally speaking, by a simple modification.

This modification:

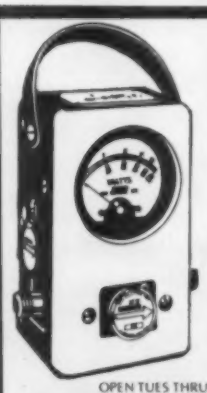
1. Eliminates out-of-band operation forever;
2. Provides instant monitoring of a repeater input frequency;
3. Costs nothing, requires no parts, and is easily restored.

To proceed, disconnect the power to the radio and remove the bottom cover. Looking at the large receiver board from the front, locate wire-wrap pin "TS" at the left front edge of the board near the relay. Remove the wire end from the pin by unwrapping. Now locate wire-wrap pin "RS" located at the right front of the board somewhat in from the right edge. Remove the wire from the pin by unwrapping. Slip this wire back through the cabling until it will reach pin "TS". Trim off excess bare wire and solder to pin "TS". Finally, splice about three inches of insulated wire to the remaining wire and solder to the "RS" pin.

Voilà! The "TX OFFSET" switch now becomes an "RX OFFSET" switch. The radio will now transmit only the frequency displayed on the LED readout (and the selector switches). No more accidental out-of-band transmitting when operating above 147.400 MHz! The "RX OFFSET" switch now affects only the receiver frequency and provides the +600 and −600 kilohertz offset function as marked. When working through a repeater, the operator may instantly check the input frequency by flipping the switch to "SIMPLEX" to see if the station being worked can be heard directly, indicating that a move to a simplex frequency would be in order. Simplex operation is the same as before modification.

As a final touch, a white decal letter "R" may be applied in place over the "T" above the offset switch and the caption "TRANSMITTER FREQUENCY" can be applied above the LED readout. Shouldn't all transceivers operate this way?

Credits to the Anaheim (CA) Amateur Radio Club and WB6ZFU for providing the information on the "RS" and "TS" functions.■



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Inexpensive Scope Tuner

—"budget here is QRP, OM"

Build your own.

After I looked for a long time at the Heathkit SB-614 monitor scope and the Yaesu YO-100, I realized that I had no choice except to build my own tuner for my 3" general-purpose oscilloscope. Building the tuner according to the *Handbook* would cost too much here in Canada, and besides, it lacked the simplicity I wanted.

I built the tuner with parts I had on hand, so I hesitate to place any dollar values on them.

The balun was a kW 50-75 Ohm one. R1 is used to broaden the frequency response of the balun.

C1 and C2 can be changed to suit the power output.

The unit was tested with my Yaesu FT-101B on 10, 15, 20, 40, and 80 meters. Minimum meshing of the tuning capacitor, C2, was required on all bands.

Use RG-58/U or RG-59/U to connect the tuner to the scope.

It is important that the box is rf-leakproof! The Radio Shack metal cabinet I used has vent slots, and when I keyed the rig, my digital clock went into orbit!

My next project will be to reduce the size of the tuner and combine it with an swr bridge in one cabinet in order to eliminate the box and the coaxial jacks.■

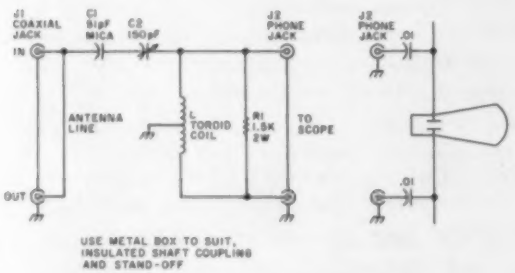

Fig. 1. Modification to a general-purpose oscilloscope to allow direct input to the vertical deflection plate. The capacitors are 1-kV discs.

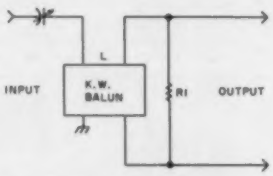

Fig. 2. General arrangement.

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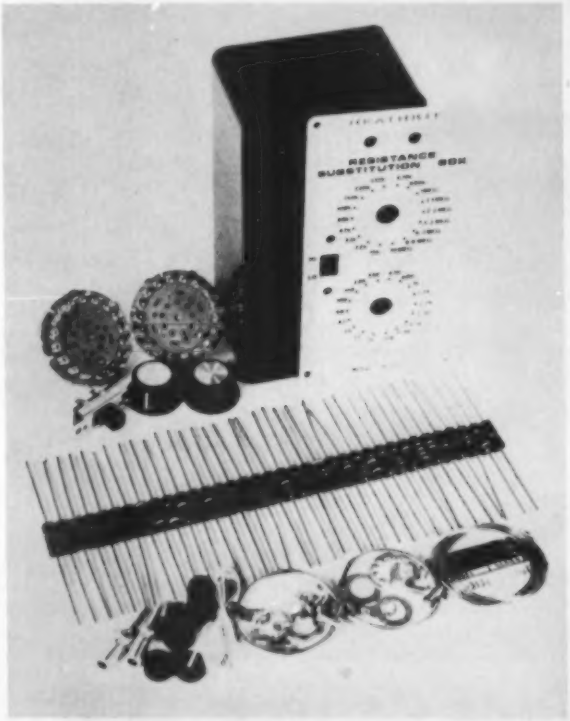
The Resistance Substitution Box

—a ham's forgotten friend

Does a lot for a little.



Here's what they pack into a 3"W × 2¼"D × 6"H case. These are husky parts, too, not flimsy.

In previous articles, I have been known to breezily advise readers to adjust a resistance value. If you are sitting there with a 100k, ¼-Watt carbon film resistor trying to figure out how to adjust it, you are probably thinking about getting me alone in a room for five minutes and adjusting me. That's not fair.

In self-defense, and to help solve the problem, I will tell you about one of the most useful pieces of test equipment and tools available to the experimenter or anyone who repairs equipment.

I have wanted to write this article for a long time, but I kept putting it off, trying to see if it couldn't be presented as a nice easy construction project which would save all sorts of money. What it kept coming down to was that I could save a few dollars rolling my own, but a reader might not be able to duplicate it easily, and the few bucks wasn't worth the irritation.

The tool is a resistance substitution box. A kit version represents one of the best dollar values around. The price for the whole kit is so close to what the parts would cost that it actually represents a greater value. Everything is done for you. You just have to put it together. That's getting most of the hand labor almost free.

I bought the Heathkit model IN-3137 in kit form. The first thing you notice is that you get a husky handful of parts. In spite of the relatively small price, this is a meaty kit.

The Heath instructions are well known and there were only a few sticky places not really pointed out. They are in the area of general construction hints.

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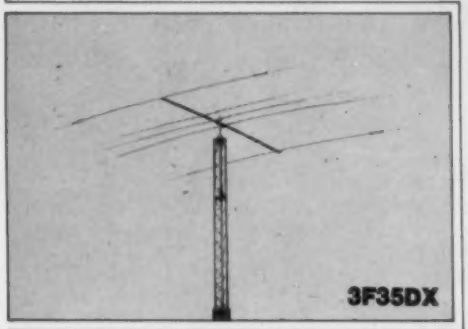
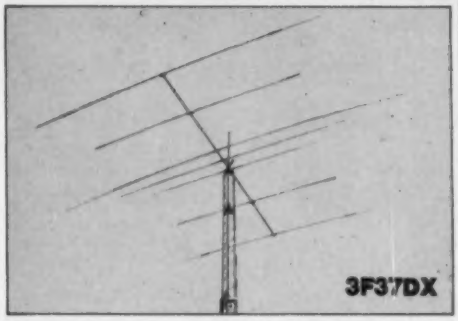
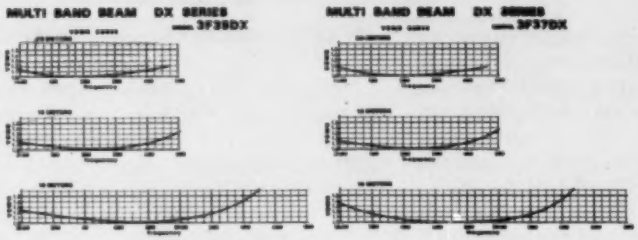
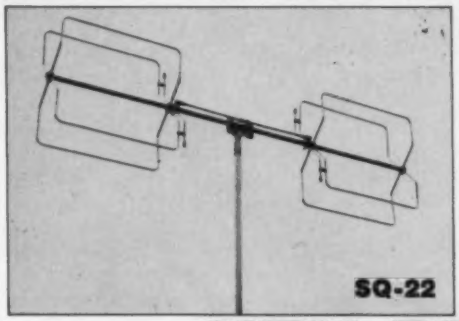




MODEL		3F37DX	3F35DX
BAND		14 21 28	14 21 28
ELEMENTS		7	5
ELEMENTS PER BAND	20m	3	3
	15m	5	3
	10m	5	3
ANTENNA GAIN	20m	8.5dB	8.0dB
	15m	10dB	8.5dB
	10m	10dB	8.0dB
FRONT BACK RATIO		25dB	20-25dB
MAX. POWER INPUT		3kw	3kw
VSWR		1.5 or better	1.5 or better
IMPEDANCE		50Ω	50Ω
MAX. ELEMENT L.		10.5m	10.5m
BOOM LENGTH		7.5m	5.0m
BOOM DIAMETER		50mm	50mm
TURNING RADIUS		5.3m	5.25m
WIND RATING		40m/sec.	40m/sec.
SUITABLE MAST		50mm	50mm
WEIGHT		23kg	17kg





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When mounting the two binding posts, it helps to put a small nail or something through the little hole so you have a handle to hold the hole in position when you tighten the mounting nut. This way the pieces will be lined up the way you want them rather than just randomly as they happen to hold.

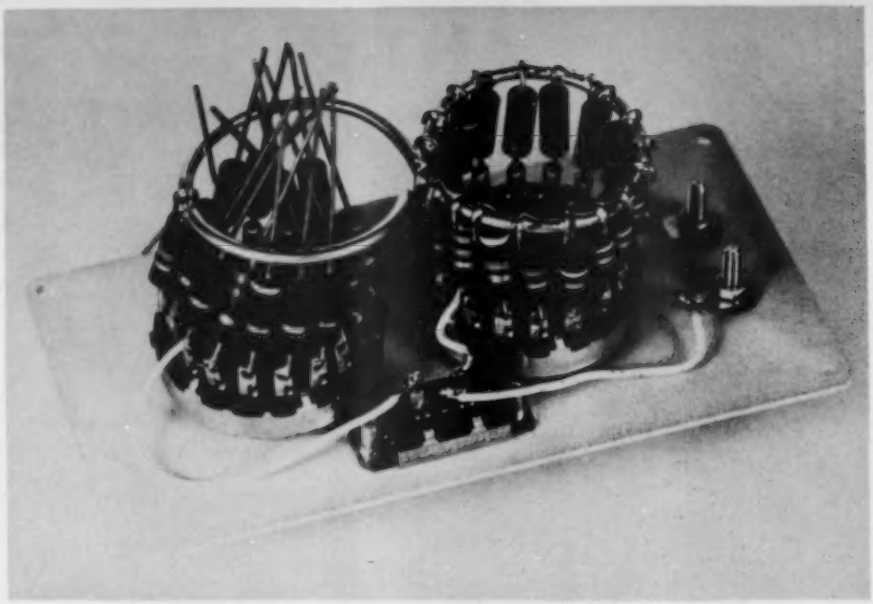
The only fussy job in the kit is soldering the mounting ring that holds the ground end of all the resistors. This shows in the photo. It just takes a little care and forethought. You want to have the resistors mounted evenly and the ring at the correct height so that the finished assembly will fit in the case.

Do the first resistor at the right height as per the instructions, and then choose a resistor at the other end of the ring and do it. If you space about four resistors around the ring, it will let you set the ring at the correct height easily and make a fairly rigid assembly to mount the other resistors to without worrying about the lead length. I did not think of this until after I did the soldering of each resistor in order, so mine looks a bit lopsided.

There really were no problems putting the kit together, and I could only fault it slightly in a few areas.

I would have liked to have color-coded binding posts—one red, one black—to tell which one went to the big lump of metal. It can be marked on the case.

It would have been nice to have a couple of color-coded insulated clip leads supplied. With all the test gear hooked up for testing, that's one thing you may be shy of when you go to use the box. It doesn't cost much to make your own, but you won't think of it until you are working and need them NOW.



The only sticky part is mounting this S-ring full of resistors. The text gives some hints.

There are a few other construction hints to keep in mind. As you put it together, remember that you may have to take it apart.

Unless you just plan to look at it on the bench, you will probably fry a few resistors along the way like the rest of us. They will have to be replaced. Don't wire them in for the ages.

It may still seem a bit exorbitant to spend that much for a box of resistors and a few switches. I got along without one for a while, but, once I had one, I did not want to do without it.

Years ago, I would use clip leads and wire in a resistor near what I wanted from the junk box. I had an assortment of values, none too complete, but it did work. The problem was that it was clumsy and it took far too much time. Also, the box is a lot more precise than you might think.

In Fig. 1, the problem is to determine the resistance value to allow only so much current to the LED. From looking at circuits, you have some idea of the current range most LED circuits take.

Let's fill in some more. You don't know what the junk-box LED is rated at, so you want to go easy. You can tell a bit from the way it lights, assuming you don't blow it right off the bat.

Hook up the VOM to read milliamperes (low range) and the box in place of R1. Start at a high value of resistance—in this case 10k. You might as well get into the habit of starting at the very top. Slowly click your way down range. Watch the meter and the LED carefully. At some point, the LED will just start to light and the meter start to read.

Most LEDs can handle about 10 mils or so. As you watch the LED, watch the meter. The LED will probably light dimly at first and get brighter as you lower the resistance and increase the current.

You may reach a point where an increase in current only makes a slight increase in actual brightness. This is about the maximum current point. For the best results, increase the resistance a notch or so until the LED starts to drop off the other way. Somewhere in that range is where you want to be. Not dim, but not the brightest it will go. That 10-mA figure is a good target for an unknown LED.

This is the best working range for the LED. If you have to save current—perhaps you are running a lot of LEDs from a battery—you might even want a dim light and a smaller current. Here, current would be the main factor.

The point is that, using individual resistors and clip leads, you would have only had time to try one or two in the time it took to read this. Using the box, you would probably have completed the job in that much time and in a far more controlled and safe manner.

Let's take another job. You are working in an audio section. You have a

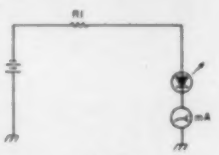


Fig. 1.

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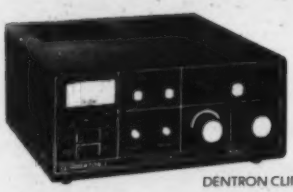

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dead triode amplifier stage. You look in and find that the plate load resistor is fried to a crispy color. What was it?

You can get a hint from similar circuits or maybe what else is in the set, but, if you want to get it going fast, it's easy.

First check for other damage, like a shorted bypass capacitor that caused the resistor to draw too much current, or any other trouble in the circuit which should be corrected before replacing parts (you don't want to burn up the replacement resistor, particularly the one in your substitution box).

Clip the box into the circuit set at its highest value. Then click down as you monitor the stage. If nothing else is wrong with the stage, it should click in at some point. Play around and choose the best value for operation, then replace the box with the fixed value.

Of course, you can see how handy the box would be for experimental purposes if you were designing a stage. It makes it a breeze to try values and evaluate performance quickly. The nice thing is, the box will work just as well with tube or transistor circuits. The one-Watt values are good for most tube circuits and a higher percentage of transistor work.

The one way you can immediately damage it is to send too much current through one of the resistors. The use of a milliammeter is recommended. Also, the switch is rated at only 500 volts.

A little common sense about what you hook it to can help, too. Before you start clicking, use your pocket calculator to figure Ohm's Law for a few of the values and see what the current and power would be.

Most of the time, a little thought will keep you on the safe side of the power ratings. Once in a while, you may hit the box too hard. Get out the iron and welcome to the club.

There is one big thing to watch for. If the circuit calls for a power job, or you see one in there already, keep the box out of there. Even for a short test, it's risky.

Sooner or later you will put too much current through one or more of the resistors. This happens to everybody. It is the fate of the experimenter. A little bit of preventive care and knowledge will go a long way toward helping you over this problem. Besides care in construction, you should have a bit more detailed knowledge of what's in there.

When you build, or buy, your RC box, hook up your best ohmmeter to it. I hope that you have something that is fairly accurate.

I keep a few 1% resistors handy to check mine with. It doesn't have to be a lab meter. Mine is rated a nominal 3%. The box resistors are within 10%.

Go through the whole range of resistances and write down what they all measure when the box is new. File the information with the book that came with it. Then it's easy to go back and check it every now and then or when you think you might have fried something. You will have a known set of standards to compare with.

When you make the chart, do not fuss if they do not seem to be exactly right on the nose. They are only supposed to be within 10%. At 100k, you could read 90k to 110k Ohms.

If you have it wired correctly, they should all be within tolerance. You might possibly have one or two out. It could be a faulty resistor, or maybe it got too much heat. If you have more than that, you had better check your meter out with a friend's before complaining.

To repair the box, just measure the values and replace the ones that got out of tolerance. You can assume that they will age and they will get some current once in a while.

While the values seem far apart when compared to the chart of available resistor values, they are effectively within range of each other. The in-between values will make a difference in actual circuit operation, but the box values will make what might be called a significant difference. It's big enough that the difference will be noticeable, but not so much that it doesn't have a safety margin. With care, you should have plenty of notice that you are getting near a danger point of operation.

While it won't do your fine pruning, it will put you in the range you want to be and should give you an operative circuit value.

One obvious question is, what about all those 1% transistor circuits you seem to have to work with? Well, they would be a problem no matter what you were using. The basic problem is that there really is no such thing as a 1% circuit in electronics. It may be that when it rolls off the assembly line (most aren't), but give it a while and it will be out of tolerance.

For most uses, you have no business making a circuit that is that critical. Most tube and transistor circuits are nominally within ten percent when new.

After regular use, most circuits I've worked with were within 20%. Most

The completed box has a nice husky feel to it and won't get lost on your bench.

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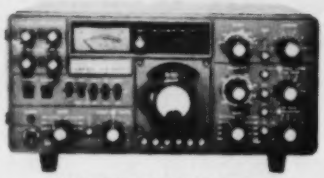

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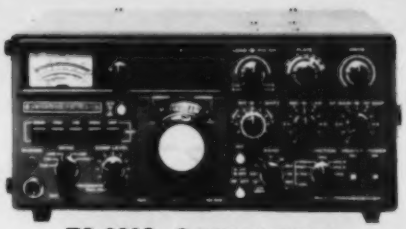

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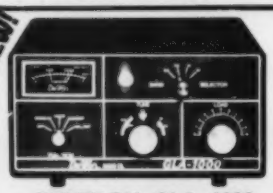

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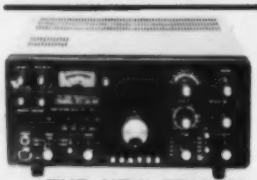

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If you are designing your own equipment, aim for noncritical design and standard parts values. That little bit of theoretical advantage in optimizing can be quickly offset by normal aging and servicing problems.

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Most functions can be performed by noncritical circuitry. The added stability to be gained thereby can be quite valuable.

Save the critical circuits for where you need them. Even then, it pays to use common sense about values. Is it something you are going to be able to get a replacement for in X amount of time? That's something to think about.

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Reader Service—see page 195

Imagine All The Places You Can Tuck ICOM's Remotable IC-280. (Think small.)

The **IC-280** 2 meter mobile comes as one radio to be mounted in the normal manner: but, as an option, the diminutive front one third of the radio detaches and mounts by its optional bracket, while the main body tucks neatly away out of sight. Now you can mount your 2 meter radio in pint-sized places that seemed far too cramped before.

Measuring only 2¼"h x 7"w x 3⅜"d, the bantam-sized microprocessor control head fits easily into the dash, console or glove box of even the most compact vehicle. Or if those places are already taken by the rest of your "mobile shack," the **IC-280** head squeezes into leftover nitches under the dash, overhead, under the seat or even on the steering column.

But don't be misled by the petite size of this subdivided radio: the **IC-280** is jam packed with the latest state of the art engineering and convenience features. No scaled down technology here!

With the microprocessor in the detachable control head, your **IC-280** can store three frequencies of your choice plus the dial, which allows you to select from four frequencies with the front panel switch without taking your eyes off the road. These frequencies are retained in the **IC-280's** memory for as long as power is applied to the radio, even when power is turned off at the front panel switch. And if power is completely removed from the radio the ±600 KHz splits are still maintained!

The **IC-280** works frequencies in excess of the 2 meter band with ICOM's outstanding single-knob tuning, so you can listen around the entire band without fooling with three tuning knobs. With steps of 15 KC or 5 KC, the **IC-280** puts rapid and easy frequency change at your single fingertip and instantly displays bright, easy to read LED's.

Available Options:
- Touch Tone pad/microphone combination, which fits the mic plug on the radio face with absolutely no modification
  (Fits all ICOM 4-pin mic radios.)
- 15' unassembled cable kit for long distance remote mounting of the detachable control head

IC-280
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IC-280 Specifications: ☐ Frequency Coverage: 143.90—148.11 MHz ☐ Operating Conditions: Temperature: −10°C to 60°C (14°F to 140°F), Duty Factor: continuous ☐ Frequency Stability: ±1.5 KHz ☐ Modulation Type: FM (F3) ☐ Antenna Impedance: 50 ohms unbalanced ☐ Power Requirement: DC 13.8V ±15% (negative ground) ☐ Current Drain: Transmitting: 2.5A Hi (10W), 1.2A Lo (1W), Receiving: 0.630A at max audio output, 0.450 at SQL ON with no signal ☐ Size: 58mm(h) x 156mm(w) x 228mm(d) ☐ Weight: approx. 2.2 Kg ☐ Power Output: 10W Hi, 1W Lo ☐ Modulation System: Phase ☐ Max. Frequency Deviation: ±5 KHz ☐ Spurious Output: more than 60 dB below carrier ☐ Microphone Impedance: 600 ohms dynamic or electret condenser type, such as the SM-2 ☐ Receiving System: Double superheterodyne ☐ Intermediate Frequency: 1st: 10.695 MHz, 2nd: 455 KHz ☐ Sensitivity: 1 uv at S +N/N at 30 dB or better, Noise suppression sensitivity 20 dB, 0.6 uv or less ☐ Selectivity: less than ±7.5 KHz at −6 dB, less than ±15 KHz at −60 dB ☐ Audio Output: More than 1.5W ☐ Audio Output Impedance: 8 ohms

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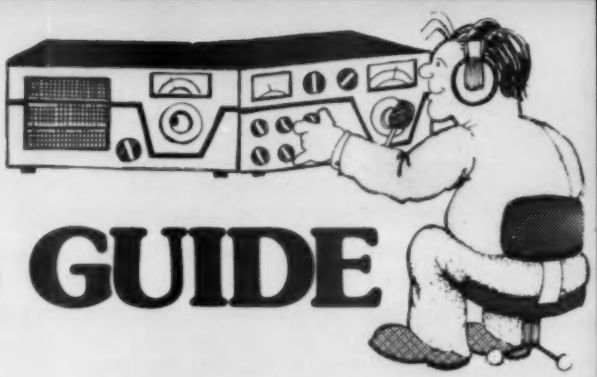

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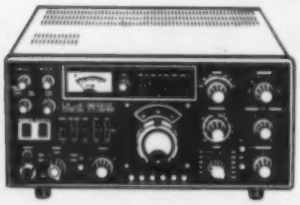

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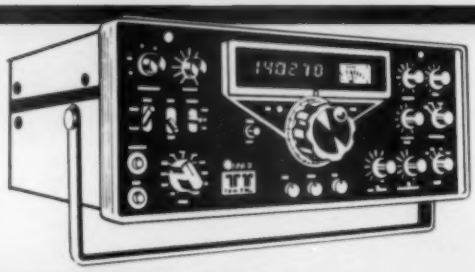

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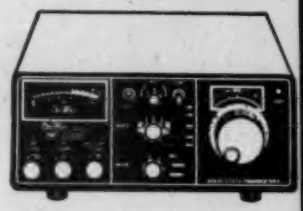
Cover 80-10 meters, completely solid state, 200W, 28.500 MHz-29.000 MHz standard from factory (other crystals optional), modes: USB, LSB, CW, RTTY, CW, and SSTV, power supply requirements: 13.6 VDC unregulated 20 A, power input: SSB-200W PEP, CW-200W, load impedance: 50 ohms, low dynamic mic input, RIT, VSWR: no internal shut down of power amplifier at any SWR ratio. HF-ACS power supply available.



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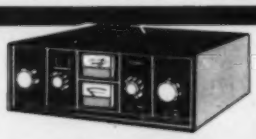

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Dentron's ultimate tuner! For coax, random wire, and balanced feed systems, built-in antenna selector switch for 5 different antennas, power handling 3 KW PEP, built-in 50 ohm 250W dummy load, dual watt meters, 3 core heavy duty balun, continuous tuning: 160 to 10 meters.

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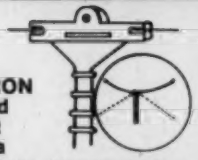

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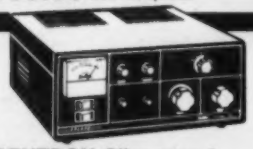

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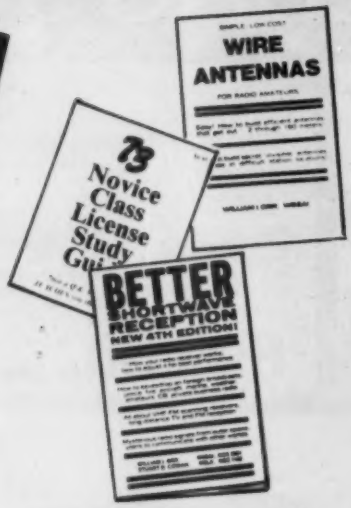

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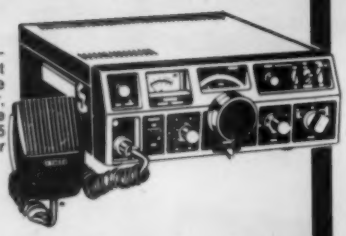

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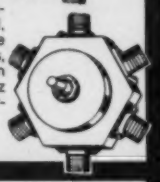

B&W 593 3 position coax switch
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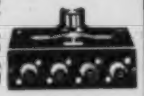

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Vodka Amongst the Penguins

— hamming with the Russians in Antarctica

Mirnyy, 1961.

"Stew, how would you like to go to Antarctica for a year with the Russians?" Professor Bob Helliwell asked me one morning at Stanford University, California, in November, 1960.

"Sure," I said, "when do I go?"

"Well," said Helliwell, "you'll leave right away. That is, *if* you get the job!"

He explained that the National Bureau of Standards at Boulder, Colorado, under a National Science Foundation grant, was sponsoring a US exchange scientist to go with the sixth Soviet Antarctic expedition to Mirnyy Base, Antarctica. They were interviewing several people at Boulder right then.

"Something happened to the original candidate, and his replacement must be chosen and must leave for Antarctica immediately," Helliwell said. "The candidate will meet the Soviet expedition ship in Capetown if he can get there in time, and the ship has already left Leningrad!"

I was hoping to finish my E. E. degree in a couple of months. I had taken one leave from school already, to work in the Azores Islands and also to study at Edinburgh, Scotland, but this chance was too good to miss. Bob Helliwell knew I was interested in Antarctica, since he was a Scoutmaster and remembered that I had narrowly missed being chosen as the Boy Scout to accompany the USIGY Antarctic Expedition. Also, I was familiar with the research work proposed by the National Bureau of Standards, since I had operated similar equipment during summers when I had worked for the Stanford Research Institute.

Photo A. The diesel ship OB is wedged in sea ice near Mirnyy, Antarctica.

Well, I was lucky enough to get the job. I was briefed quickly at NBS and at the National Science Foundation in Washington. I then left New York City in a DC-7 bound for Capetown, accompanied by crates of gear weighing over 12,000 lbs. In Capetown, I met the Soviet ice cargo freighter *OB* (named for a large river in Siberia) and proceeded to Antarctica, where I spent the next 13 months at Mirnyy, the Soviet's largest base. (See Photo A.)

Not only did I do radio-

physics research and meet and get to know many Soviet colleagues, but I also became one of the operators of UA1KAE, which was for some years Antarctica's only active Soviet ham radio station. During my interesting time with the Soviets, I traveled to numerous locations in the Antarctic. These included the Soviet Vostok station at the southern geomagnetic pole, where the world record for minimum temperature was set (−126.9° F., recorded in August, 1960), and the US station at the geographic South Pole.

I spent most of my time at Mirnyy station, located at about 93° E, 67° S, on the coast of eastern Antarctica. (See Photo B.) Mirnyy is situated on continental ice anchored by underlying rock formations near the sea. There is a dangerously steep 50-foot cliff overlooking the sea to the north; two hills protrude from the ice. UA1KAE, the ham station, and the rest of the radio transmitting equipment (shown in Photo C) are located on one of these hills—"Sopka Radio," which means Radio Hill. Mirnyy had a population of about 100 persons in the winter, including 20 assorted geophysicists and meteorologists. (See Photo D.) Most of us lived in separate buildings having from 3 to 12 occupants each, and, when weather permitted, we traveled along "Lenin Avenue" (see Photo E) to a central dining hall for meals, meetings and movies.

My main purpose in going to the Antarctic, besides serving as a guest and exchange scientist with the Russians, was to initiate a program of cosmic radio noise measurements in the Antarctic. To make these radio noise measurements, I brought along two Riometers. The Riometer was first designed to study auroral radio-wave absorption in Alaska, and the name was coined from *R*elative-*I*onospheric-*O*pacity meter. The instrument itself was based on noise-measuring gear developed for radio astronomy. But whereas a radio astronomer would use such a receiver to measure galactic radio noise, I would use stellar radio noise as a signal source to measure the *absorption* of this noise at HF in the ionosphere. The absorption I measured is caused by, or associated with, solar storms, aurorae, and other geophysical events.

Study of the upper ionized layers of the Earth's atmosphere, both from ground level and from rockets and satellites, is important not only for increased knowledge of plasma physics, wave propagation, and geophysics, but also it contributes to our daily efficient use of the radio spectrum for telecommunications. Back in 1925, Merle Tuve and Gregory Breit, at the Carnegie Institution's Department of Terrestrial Magnetism in Washington DC, first studied the ionosphere vertically using a pulsed, vertical-sounding transmitter and receiver—a crude radar. This technique was further developed during the 1930s and during World War II, and the standard instrument which evolved came to be known as the Ionosonde.

This device, often using a delta or half-rhombic antenna aimed at the zenith, sends pulses skyward over a broad range of frequencies from 2 to about 25 MHz. The reflected signals received at the ground allow one to measure the "height" of the ionospheric layers and the electron density at the peak of the reflecting layers. This type of approach has been used even in the polar areas for many years.

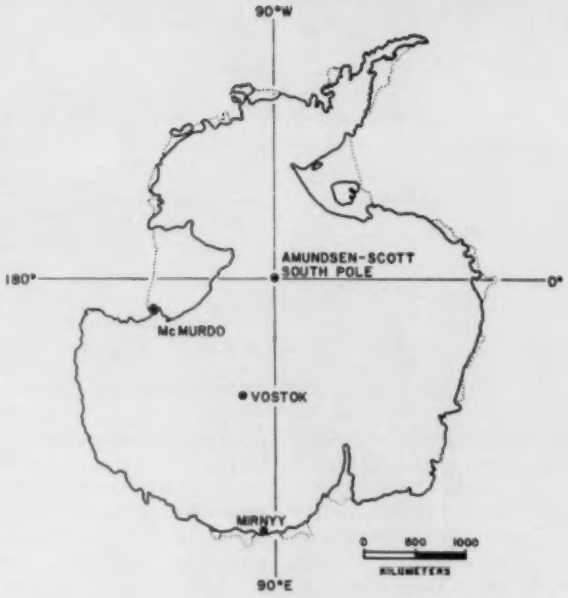

Photo B. This is a picture of a map of Antarctica which was drafted by the author's wife. It shows the location of the four stations.

Lt. Malcolm P. Hanson, of the US Naval Research Laboratory, constructed equipment and made the first such polar measurements while on Byrd's first Antarctic expedition, in 1929-30. Edward V. Appleton, who won the Nobel Prize in physics in 1947 for his ionosphere researches, utilized similar equipment in northern Norway during the 2nd International Polar Year in 1932-33. (The general history of radio research in Antarctica is covered in my essay, "Early History of Upper Atmospheric Physics Research in Antarctica," L. J. Lanzerotti and C. G. Park, editors, in *Upper Atmosphere Research in Antarctica*, American Geophysical Union, Washington DC, 1978.)

The Ionosonde has definite limits to its use in polar regions: The man-made signals have to pass through the ionosphere twice, being absorbed on

Photo C. "Sopka Radio" (Radio Hill), where the Mirnyy transmitters and UA1KAE were located.

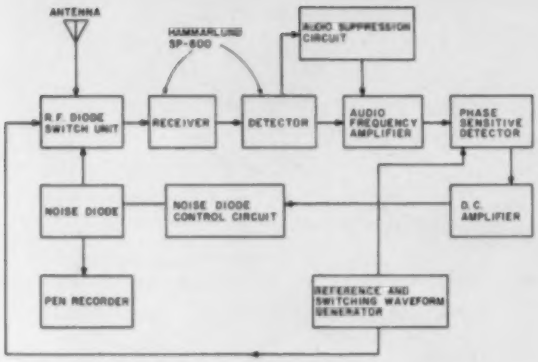

Fig. 1. Block diagram of Riometer.

passing up from the ground and then absorbed again upon returning down towards the receiver. During active auroral events or after solar storms, the absorption of radio waves at MF and HF is frequently so high that no signal is received on the ground, and the ionosphere is said to be in "blackout" condition. It is so-called because the Ionosonde record shows no evidence of returning pulses.

It is just *during* these events, however, that so much of importance happens in radiophysics. C. G. Little and H. Leinbach, the designers of the Riometer (*Proceedings, I. R. E., 47,* p. 315, 1959), realized that if a signal source could be placed outside the Earth's ionosphere, the signal would suffer much less absorption. The device could then report continuously, even during total radio communications blackouts. In addition, the Riometer could measure absorption at frequencies as high as 50, or even 150 MHz, where no vertical pulses under normal conditions would be reflected from the ionosphere.

Of the two Riometers I brought with me, one was for use at 30 MHz as the primary unit and the other was a backup unit which could also be used at 50 MHz. (See Photo F.) Ionospheric absorption usually varies as the inverse square of the frequency; thus the 50-MHz unit could be expected to measure $(30/50)^2$, or about 0.36 as much absorption as the 30-MHz unit. The Riometer needed as its heart a good receiver. We chose the Hammarlund SP-600, since it was capable of operating with a bandwidth of about 13 kHz and covered the HF bands up through 6 meters, thus allowing me to operate either unit on 30 or on 50 MHz.

Basically, the Riometer is a servo-controlled, self-balancing receiving system designed to measure ionospheric absorption by monitoring "cosmic noise." The block diagram of an early version is shown in Fig. 1. Reference to this diagram will facilitate interpretation of the following description.

The diode switch unit switches between the antenna and the servo noise diode at an audio rate. The resulting signal is fed into a low-noise receiver (the SP-600) whose detected output consists of alternated noise from the antenna and from the servo noise diode. If the two inputs are balanced, the detector output looks like an audio square wave.

The receiver-detector output is fed through an audio suppression circuit and an audio amplifier into a phase-sensitive detector. (The audio suppression circuit breaks the servo loop when a strong interfering signal is present.) The dc output of the phase-sensitive detector depends in amplitude and sign on the unbalance between the noise-diode signal and the antenna signal. The output of the phase-sensitive detector is fed to a dc amplifier whose output constitutes the input signal to the noise-diode control circuit, which functions in such a manner as to bring the noise output of the servo noise diode into equality with the noise signal power from the antenna.

The plate current of the servo noise diode is directly proportional to the input power of the antenna signal and is recorded on a pen recorder. Additional refinements, such as sweeping the local oscillator of the receiver through 100 kHz and using a minimum signal detector, serve to minimize the effects of interference on the Riometer. Solid-state Riometers having digital output and automatic data processing are now in use, but my vacuum tube units at Mirnyy in 1961 were quite similar to the original design of Little and Leinbach. They required daily calibration and adjustment.

The Riometer was a big improvement over merely measuring receiver noise power, since the noise-diode current could be carefully measured each day and receiver-gain changes with tube aging had only a minor effect on the system. We wanted results accurate to one- or two-tenths of a dB over periods of a year. I had a very fancy ac-powered pen recorder, but I found the 50-Hz power at Mirnyy varied by several Hz throughout the day, so I went back to using two old standard spring-wound Esterline-Angus pen recorders which I could adjust to record with an accuracy of about plus or minus a couple of minutes a day.

In addition to the Riometers, I had assorted test gear: two Hewlett-Packard 'scopes, an rf bridge and signal generator, an H-P VTVM, and a Hickok tube-tester. I also had the loan of a fine Collins 51J4 receiver, courtesy of Mike Villard W6QYT of Stanford University. With this, I hoped to monitor short-wave-broadcast-station signal strengths after solar storm events and also try to listen for around-the-world echoes (and maybe long-delay echoes) from Villard's experimental transmissions on 21 MHz. I

Photo D. A cold and windy "May Day," 1961, at Mirnyy; the author is third from the left. The power lines are from diesel-powered electric generators and run to the buildings where heat coils feed hot water radiator systems.

never heard any long-delay echoes, but in free hours I did get quite a bit of pleasure from monitoring baseball and football games broadcast over Armed Forces Radio, and I often caught Willis Conover's Voice of America Jazz Show.

For a student research project at Stanford, I had constructed a large, 84-element, 4-boom log periodic antenna array on a rotating 60-foot tower, combined with a 25-to-35-MHz sweep-frequency receiving system for solar and planetary radio astronomy investigations (see *Electrical Engineering, 81,* p. 22, 1962). Of course, I couldn't bring the LPA array with me, but I did bring the receiving system. I hoped to erect a rhombic antenna and continue my measurements at Mirnyy. Although I made a few measurements, my first priority was to the Riometer work, and I didn't do much with the sweep-frequency radio astronomy gear.

In addition to the above, I also brought with me an Ampex tape recorder and a small solid-state (remember, we called them "transistorized" in those days) Develco audio amplifier and loop antenna to record geophysical noises in the VLF range from about 100 Hz to 10 kHz. Bob Helliwell had loaned this equipment to me. VLF recording was becoming of great importance to upper atmospheric and space physics research. Today, VLF research has assumed even greater importance for plasma geophysics *and* telecommunications research. Lightning strokes and other natural phenomena sometimes propagate as radio frequency energy along magnetic field lines from one end of the Earth out thousands of miles and then re-enter the atmosphere at the other end of the field line.

Each different frequency—say, of the lightning stroke—propagates with a different velocity, so that a pulse which sounds initially like a "click" near the source may sound like a long whistle, decreasing in pitch, at the other end of the Earth. As it turned out, a Czech visiting scientist had recorded "whistler" and VLF activity at Mirnyy station for some months before my arrival. Thus I sent the whistler gear on to Vostok station, a unique location with *geomagnetic* coordinates near 90° S—something like Thule, Greenland, in the north. No one then knew what sort of whistler activity would be heard at Vostok, since it was at such a high geomagnetic latitude.

Although modern VLF work in the Antarctic dates from the late 1950s, VLF work in the polar regions was initiated on Byrd's 2nd Antarctic expedition in 1933-34 by John Dyer (now W1BJD). In those days, there were hopes of connecting "whistlers" with meteor sightings. Dyer never published his fascinating VLF observations, but correctly he noted no correlation between whistlers and meteors. My VLF measurements had only limited success, but my Riometer results were first in what has been a continuous and growing use of this radio wave-absorption measuring technique in Antarctica.

When I first arrived at Mirnyy, I wished I had brought an HF transmitter with me for ham radio purposes. I had been licensed first in 1953 as WNØODE, as a high-school freshman in Grandview, Missouri, and I had kept somewhat active as WØODE and at the Stanford student station, W6YX. Looking through my stock of vacuum tubes, I figured that I could build a CW transmitter using a 12AU7 or 6AH6 as a vfo, a 6AG7 driver, and push-pull 6L6s running 75 Watts on 40, 20, and 15 meters. I knew I wouldn't have time to do any rig-building for several months, since we all had so much work to do to get the general aspects of the expedition in order and to get the various scientific experiments working.

Photo E. This is "Lenin Avenue," the main drag at Mirnyy. The picture is taken from Radio Hill looking north to the other rocky hill, which is at the edge of the sea ice.

For example, the anten-

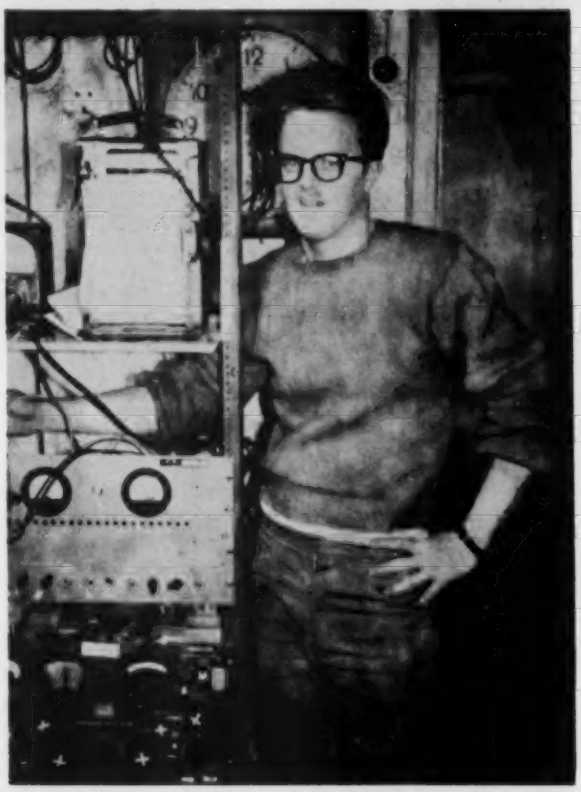

Photo F. The author is standing beside the 30-MHz and 50-MHz Riometers. Also shown are the power supplies, Esterline-Angus chart recorders, test gear, and Hammarlund SP-600 receivers.

nas for my Riometers—see Photo G—were broadband, 4-element yagis—that is, two driven elements, each over a reflector, phased so that the beamwidth would be approximately circular. These elements were of aluminum pipe approximately 3 inches in diameter, placed around very heavy fiberglass poles. Erecting this array took quite a bit of time. Because of local conditions, I eventually replaced this rather elegant design with a simple wire dipole placed over a metal roof as the reflector.

Well, I mused over my proposed 6L6 rig and wrote a letter to the FCC to be mailed to them when the Soviet ship *OB* left the Antarctic to return to Leningrad. I wondered whether or not I should operate as WØODE/KC4. I was on a continent not claimed by the US (or by the USSR, for that matter), and I was not on a US expedition.

In the meantime, I got a chance to visit the radio communications center at the base. This building had a small studio room for broadcasting to Moscow, a room for Teletype™ equipment, and a general operating room containing tape recorders and several MF, HF, and VHF receivers. I learned that the military HF receivers used at Mirnyy covered 1.5 to 25.5 MHz. The transmitters, however, were not in the communications center but were located on Radio Hill, about a half mile away. This was done in an attempt to lessen local QRM when the station was operating simultaneously on several frequencies.

Quite soon thereafter, I wandered up to the transmitter building and spent about an hour listening on 20 meters. I heard good signals from South America and also from several strong ham stations in the US. I also heard KC4USV at McMurdo Sound, Antarctica.

I was told that the transmitter building was, in fact, the location of ham station UA1KAE. (See Photo H.) KAE signified *A*ntarctic *K*ontinental *E*xpedition; the UA1 indicated that the expedition's home base was Leningrad. I was told also that I could be one of the operators of UA1KAE. The station didn't operate during the austral summer since everyone was too busy, but as soon as Antarctic autumn came around in March, I began to go up to the ham station once or twice a week, when weather conditions permitted. We had several transmitters at Mirnyy, some of 5 kW and one or two of 1-to-2k-W input. It was one of these latter transmitters, usually with dipole antennas, that was used for hamming.

UA1KAE had averaged about 1500 QSOs per year since it had been set up in 1957. The transmitter was not capable of SSB operation. I attempted to operate AM, but the rig didn't seem capable of much modulation, so my contacts were nearly all CW, at least one-way. I usually worked 20 meters, although I did get on 15 and 40 meters. I didn't operate UA1KAE as often as I might have wished due to my own work schedule and also due to our weather. It doesn't get very cold at Mirnyy. Unlike Vostok, which regularly runs at about −100° F. in winter, Mirnyy rarely gets below −40° F. On the other hand, Mirnyy has a heck of a wind-chill factor!

Mirnyy is located on the east coast of Antarctica, where the world's worst storms occur. The cold inland bases have no wind to speak of during really cold periods, but winds come down off the 10,000- to 13,000-foot plateaus of east Antarctica, meet much warmer winds off the Indian Ocean, and all hell breaks loose. One time, winds broke two ¾-inch steel cables holding down one of our IL-2 aircraft (a Russian version of the DC-3). The plane took off by itself under wind power and flew about 3 miles out over the sea ice before crashing into an iceberg! Many, many days the weather was such that we could not venture outside and go the 150 yards to the dining hall, or, if we could, we had to go in teams along rope-guided paths. Thus, the ½-mile trip to Radio Hill through drifts, in blizzard conditions, forced me to cancel a number of my hamming sessions at UA1KAE.

Photo G. The author is erecting an antenna element.

One amusing thing often happened when I operated CW. UA1KAE was celebrated throughout the USSR, and there often would be Soviet ham stations piling up to work UA1KAE. In those days I did not know the Cyrillic alphabet in code (there are several extra letters such as: ya = ·—·—; ch = ———·; sh = ————; etc.). The Soviet stations, naturally, would swing into Cyrillic. I would then come back in badly *transliterated* Russian saying, "I do not write Cyrillic; I am an American operator of UA1KAE." Invariably, the Soviet operator then cut off his transmissions. I suppose at the least he thought I was a pirate station.

I did have a few CW-SSB QSOs with American hams. These were in attempts to talk with my parents in Kansas City, Missouri, and with some of my university friends in Palo Alto, California. Other hams passed traffic for me through the ham stations at McMurdo and other US

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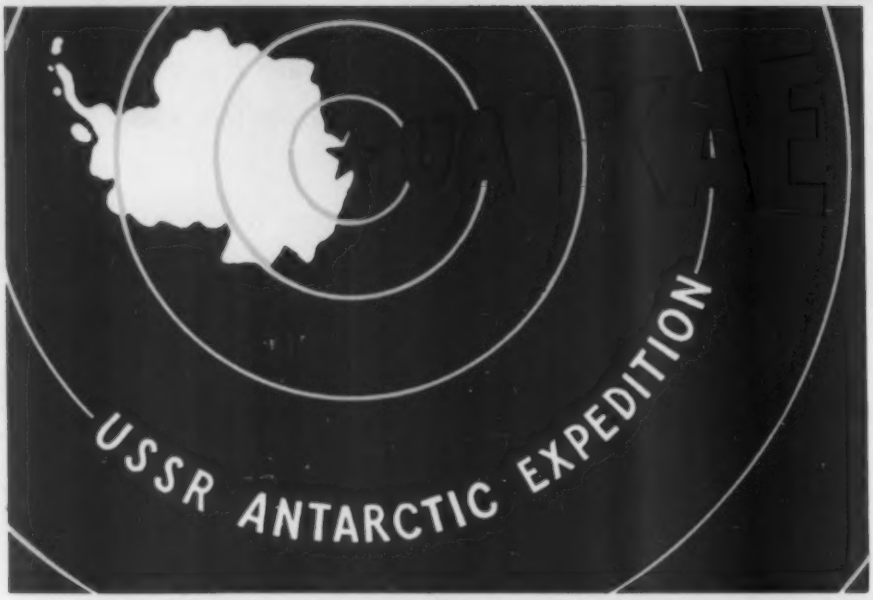

Photo H. This is the UA1KAE QSL card. The star marks Mirnyy's location.

stations; these hamgrams were then sent to me via Navy circuits from McMurdo to Mirnyy. Hams (some, regretfully, now silent keys), or calls I remember with gratitude, include Mike WØMAF, Fred W6QS, Jules K2KGJ, WØRDR, WØMM, and Lee Bergren.

I had also another quite different but amusing incident involving CW. I was asked to help get a RTTY link going between Mirnyy and McMurdo stations. We had tried for some days without success and also had had difficulty raising McMurdo on CW. I suggested that I could try McMurdo on the ham bands, and the chief radio engineer at Mirnyy agreed that it was worth the effort, so I went up to the transmitter building and listened on 20 meters sideband. Sure enough, there was KC4USV, big as life.

Now, it happened in those days (just as it does today) that ham tickets were issued at Antarctic stations to men who supposedly had qualified in the Antarctic and were given Conditional class licenses. I am pretty sure that some of those license exams were a sham. I tried to break KC4USV's stateside SSB QSO via my own CW. I tried several times, slowing my CW to well under 13 wpm. The US ham called the KC4USV op's attention to my break call, but the KC4USV op mumbled something about not being able to copy it and refused to let me break in.

A couple of days later, when communications were re-established, I sent a short comment to one of the regular Navy CW ops to the effect that at least one of the KC4USV ops had better take some of the grease out of his jaw and begin applying it to his elbow. The Navy CW op agreed with me. Little did I know that the McMurdo communications officer in charge (a) knew virtually nothing about radio, (b) was one of those individuals who had been "given" Conditional tickets, (c) was the guy at the microphone at KC4USV the day I had tried repeatedly to break in on CW, and (d) read my brief radiogram describing his performance!

That incident was almost as funny as the time a US biologist at McMurdo had a fit when I told him over the radio that the "rare" white-blooded fishes we had caught in a Mirnyy fishing contest had been eaten by us right after the event. Boy, he howled about the principles of the scientific life, the duties of the scientist and so forth, when all he really wanted was for me to haul back some fish in formaldehyde so that he could publish a paper. I told him, truthfully, that we had no formaldehyde at Mirnyy and that we had already drunk all the vodka and grain alcohol! Actually, the fish were fried up and were pretty good, tasting like perch. Penguin eggs, on the other hand, were terrible, tasting and smelling like rotten fish. (See Photo I of my friend "Little Vasily" and I trying to consume a penguin egg omelet.)

By the way, we didn't kill any birds or eat living penguin eggs at Mirnyy; the eggs we ate had been blown away from the Emperor penguin rookery in a storm and had frozen.

My Soviet friends made up in ingenuity for what they lacked in parts and supplies. While we did some rather hazardous things on aircraft flights (such as cooking lunch in flight on an open-flame burner, quite near barrels of aviation gasoline), they had a good air-safety record. Unfortunately, their fire-safety record at Mirnyy wasn't so good. Fire is a deadly enemy in the Antarctic since there is virtually no water available to fight it. Eight meteorologists were lost at Mirnyy in a fire just 4 months before I arrived.

Similarly, the Soviet communications equipment was boat anchor stuff which seemed to work pretty well. Even so, two old 1940s-vintage RCA receivers were incorporated into gear in use at Mirnyy. I assume that these were old lend-lease receivers from World War II. I had a 1960 RCA Semiconductor Handbook with me, and the electronics people were amazed and almost incredulous at the relatively large number of transistors which were then available to industry and to hams. To prove my point, I had at least the Develco VLF receiver to show for solid-state gear. NSB had already constructed solid-state Riometers, but I could not take them to Antarctica because they had not yet been through the required six months of laboratory shakedown.

Other items of great interest were my stereo music tapes, lightweight nylon clothing, Missouri corncob pipes, my Polaroid camera, and, of course, various men's picture magazines.

On my part, I found quite fascinating the Soviet's leather and fur clothing, their language, the great similarities I found between American and Soviet humor, and the way Americans and Soviets

Photo I. The author and his friend, "Little Vasily" Nikonov, a meteorologist technician, attempting to eat the terrible-tasting omelet made from Emperor penguin eggs.

Photo J. Mirnyy staff members celebrate the author's birthday, November 6, 1961.

view the world and react to numerous situations. (See Photo J.) Most of all, I found the Antarctic itself intriguing, subtle, and forbidding.

Lots of things have changed since I spent 13 months as a guest with the Soviets 18 years ago. It's much more common now to see flights in and out of Antarctica. As everywhere else, computers, microelectronics, and satellites have altered equipment, methods used, and research questions asked in the Antarctic. Mirnyy is no longer the main Soviet base, and even the Soviet ham calls have changed—being things like 4K1A instead of the old UA1KAE. But all in all, it was a great experience for me, and I recall many events fondly.

Finally, I must confess I have probably set a record or near-record for poor QSLing. In going through some old boxes last year, I found some 17-year-old QSL cards from UA1KAE for contacts I made. These had gotten mislaid in shipping my baggage out of the Antarctic in 1962. To those of you who have recently received 1961 QSO confirmation from UA1KAE postmarked 1978—sorry, fellows! ■

Note: My thanks to my wife, R. G. Gillmor, for drawing the map of Antarctica, and to A. Bothell for help with photo reproduction.

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The serious DX chaser, for example, can program various DX pileups into the four memories, and periodically check those frequencies to determine if the DX station is listening for calls from his call area. The memories are usable for transmit, receive, or transceive operation. Therefore, a memory can be used on transmit and the VFO on receive, or vice versa, either of which can be tuned up or down in frequency, for working DX stations who are listening for calls several kilohertz away from their transmitting frequency. With the push of a button, the operator can listen on his transmit frequency, which he can tune, and be ready for a perfectly timed call to the DX station, immediately after another station finishes working the DX station.

The memories are also extremely convenient for contest operating. Pileups can be stored and periodically checked for improved propagation or other conditions for "getting through". A "CQ CONTEST" frequency could also be stored.

The memories are also very useful for storing net and schedule frequencies.

What frequencies are displayed on the digital readout during memory operation?

The digital display shows the memory frequency being used, whether in receive or transmit mode. It also shows the actual VFO frequency when the VFO is activated, or the fixed-channel frequency, or the remote VFO frequency (if the optional VFO-180 is used). Separate RIT (receiver incremental tuning) controls are provided for VFO and memory/fixed-channel operation, and the RIT frequencies, when RIT is utilized, are displayed.

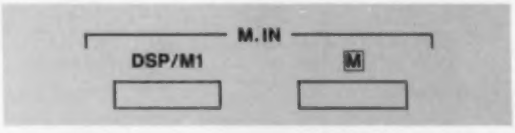
When a frequency is stored in the "M1" memory, the digital display can be switched to indicate the stored frequency and the difference between the stored and VFO frequencies (with signs to show VFO above or below the stored frequency). This function is handy for temporarily moving off of a net frequency with another station by a specified number of kilohertz, and, after completing the conversation, moving back immediately to the net frequency stored in the "M1" memory.

What are the differences between the four memories in the TS-180S with DFC?

The M1 memory is intended for fast or temporary memory operation such as moving off of a net frequency. The [M], M', and M" memories are used for relatively longer storage applications, such as for net frequencies, schedules, etc. Any of the memories can be used for storing DX or contest "pileup" frequencies or transmit or receive frequencies when working "split frequency" operation with a DX station.

How are frequencies stored in memory, and how are they recalled?

The DFC memories can store frequencies from the TS-180S internal VFO, the fixed channel, and the optional remote VFO. The RIT frequency can also be stored, and frequencies can be shifted from one memory to another. To store an operating frequency in M1, simply set the main tuning to the desired frequency and push the DSP/M1 switch; a "beep" will be heard.



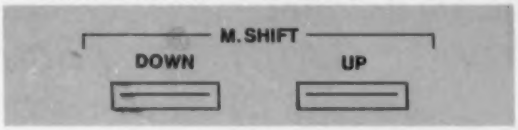
To recall the frequency stored in M1, set the M RECALL switch to M1. To receive on the memory frequency, the RCV switch should be in. To transmit on the memory frequency, the XMIT switch should be in. To transceive on the memory frequency, both the RCV and the XMIT switches should be in.

To store frequencies in the other three memories, the main tuning is set to the desired frequency (which we will call frequency A for this explanation) and the [M] switch is pushed in (a "beep" will be heard). To store frequency B, push the [M] switch to release it, and then push again ("beep"). Now frequency B will be stored in the [M] memory and frequency A will shift to the M' memory. To store frequency C, push the [M] switch to release it, and then push again ("beep"). Frequency C is now stored in [M], frequency B in M', and frequency A in M".

Storing another frequency in [M] will shift the memories again, and frequency A will be lost, unless it is recalled and stored in [M] again before another frequency is stored. Therefore, as stations in memory are worked or, for some other reason, a memory frequency is no longer needed, it can be erased automatically as it shifts out of M" where another frequency is stored in [M]. This method of moving memory frequencies "up the stack" retains the chronological order of entry for easy operation, which is particularly important in a contest. The operator, then, does not need to remember which memory in which he stored a particular frequency. To recall any of the stored frequencies, simply set the M RECALL switch to the appropriate position.

How can the memories be tuned up or down in frequency?

On the front panel of the TS-180S are a pair of paddle switches for digitally tuning any of the memories up or down in frequency.



A memory frequency can be stepped up or down 20 Hz at a time. If the UP or DOWN switch is kept depressed, the frequency changes continuously in 20-Hz steps. The rate of change can be increased by depressing the opposite switch while the appropriate switch remains depressed.

The original frequency can be recalled after it has been digitally tuned by the UP or DOWN switch, by moving the M RECALL switch to any position other than the one on which it is memorized, and then resetting it to the original memory position.

The memory frequency, after it is digitally tuned, can be stored by pushing the DSP/M1 or the [M] switch.

Will memory frequencies be retained after power is shut off?

All memorized frequencies will be retained for approximately 30 seconds after power is shut off. Memory backup batteries (Panasonic WL-14 or G-13, Eveready 357, Duracell 10L14, or RAY-O-VAC RW-22 or RW-42) may be installed to retain memory frequencies for an indefinite period after power is shut off. These batteries will function for about one year of normal operation. The batteries provide backup voltage for the [M], M', and M" memories.

The M1/DSP memory is intended for temporary applications, but can be modified for backup battery operation. The batteries are silver-oxide type and are not supplied by Trio-Kenwood. They are commonly available at local stores.

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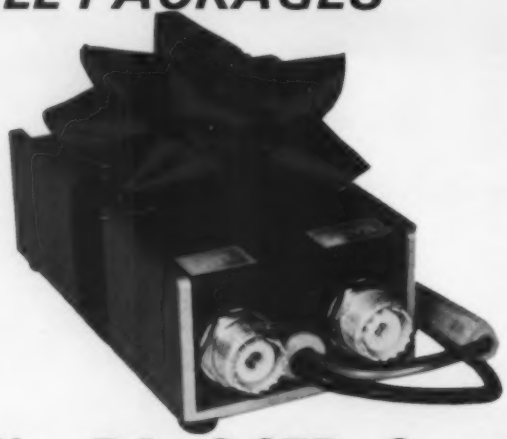

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					17° - 40°C	0° - 40°C	100 Hz - 250 MHz	90 MHz - 250 MHz	250 MHz - 450 MHz	No.	SIZE IN INCHES	.1 SEC	1 SEC
DSI INSTRUMENTS	100 HH	$ 99.95	50Hz-100MHz	TCXO	1 PPM	2 PPM	25 MV	NA	NA	8	.4	100 Hz	10 Hz
CONTINENTAL SPECIALTIES	MAX 50	$ 89.95	100Hz-50MHz	Non-Compensated	3 PPM @ 25°C	8 PPM	100 MV	NA	NA	8	.1	100 Hz	NA
DSI INSTRUMENTS	500 HH	$149.95	50Hz-550MHz	TCXO	1 PPM	2 PPM	25 MV	20 MV	30 MV	8	.4	100 Hz	10 Hz
CONTINENTAL SPECIALTIES	CSC-500	$149.95	1kHz-550MHz	Non-Compensated	3 PPM @ 25°C	8 PPM	500 MV	250 MV	250 MV	6	.1	NA	1 kHz
OPTOELECTRONICS	OPT-7000	$139.95	10Hz-600MHz	TCXO	1.8 PPM	3.2 PPM	NS	NS	NS	7	.4	1 kHz	100 Hz

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The ground fault interrupter (GFI) has been around for some time. Like many other safety devices, its popularity grows slowly because safety devices are not favored, as a rule. For an amateur radio operator, however, the GFI could be very valuable because a ham comes in contact with lots of line-operated equipment, and, inadvertently, some faulty equipment could turn up and shock the daylights out of him.

The GFI described here will prevent a normal person from suffering severe shocks by turning off the line power in approximately 25 ms when a fault current as low as 5 mA is detected. While 5 mA of 60 Hz current will cause some sensation, a persistent 10-20 mA could cause fibrillation of the heart and breathing to stop. The GFI can be built for 110 V or 220 V operation; load current capacity is rated at 25 Amps.

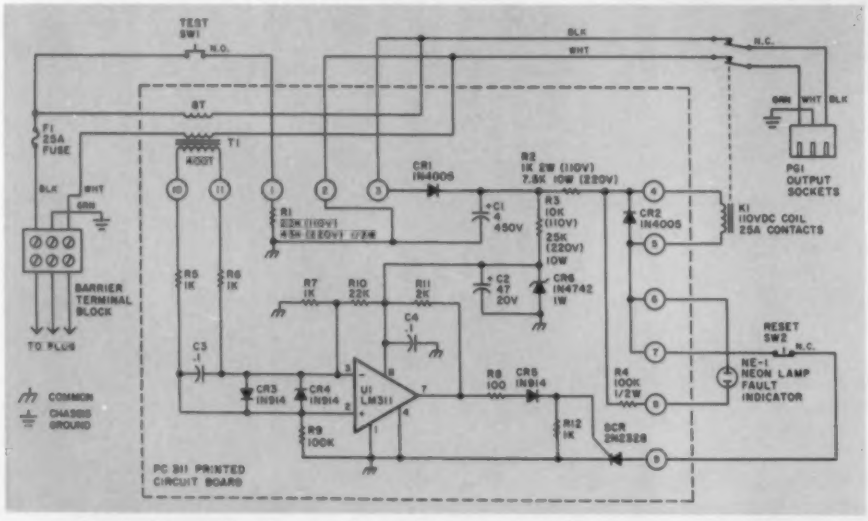

Fig. 1. Schematic diagram of portable ground fault interrupter—type 311.

How It Works

Refer to Fig. 1. The heart of the system is a differential transformer, T1, which senses an imbalance load current on the two power lines which are wound on the toroid core in a bifilar fashion. Differential current as low as 5 mA will produce a large enough signal to change the output state of the comparator, U1, whose output triggers SCR1, which in turn activates power relay K1 and shuts down output power. The whole process takes about 25 ms in the worst case. SCR1, after being activated, remains on until the reset switch is pushed.

The test switch is used to

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Model	Frequency Range	Proportional Oven Accuracy Over Temperature	50Hz To 75MHz	75MHz To 500MHz	500MHz To 1GHz	Number Of Digits	Size Of Digits	Power Requirements	Size
C700	50Hz to 700MHz	.2PPM 0° to 40°C	50MV	10MV	NA	8	.5 inch	115 VAC-BATT 8 to 15VDC	3"H x 8"W x 8"D
C1000	10Hz to 1GHz	.1PPM 0° to 40°C	20MV	1MV	>50MV	9	.5 inch	115VAC-BATT 8 to 15VDC	4"H x 10"W x 7½"D

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Photo A.

simulate a fault current of 5 mA for testing purpose. It is a good practice to test the system by the test switch prior to the use of the GFI. The neon light is used to indicate a fault and power-down condition.

For 220-V operation, a 220-V socket must be used for PG1; R1 must be changed from 22k to 43k; R2 must be changed from 1k (2 W) to 7.5 k (10 W), and R3 must be changed from 10k (10 W) to 25k (10 W). The GFI described was tested in close proximity to a high-power radio frequency transmitter and was found to be RFI-proof.

Construction

The complete system is housed in a 5" × 6" × 9" steel box. Photo A shows the GFI and Photo B shows the component layout. A printed circuit board is used to contain all electronics components. The switches, relay, light, fuse, and socket are all mounted on the front panel, but a barrier terminal block is mounted on the inside of the side wall of the box for connection to the power line cord.

Operation Hints

If the GFI keeps shutting off with a certain load, it indicates that the load or the wiring to the load has a short which provides the fault (leakage) current to trip the GFI; such a fault must be sought out and corrected before the tool or the equipment is used. In some cases, even a very low current would do damage to certain persons; hence, by no means should a person subject himself or herself to any test shock. All common sense and carefulness must be exercised when electrical power is involved; the first mistake could also be the last.■

Parts List

R1	22k (110 V), 43k (220 V), both ½ W
R2	1k (110 V) 2 W, 7.5k (220 V), 10 W
R3	10k (110 V), 25k (220 V), both 10 W
R4	100k ½ W
R5, 6, 7	1k ¼ W
R8	100 ¼ W
R9	100k ¼ W
R10	22k ¼ W
R11	2k ¼ W
R12	1k ¼ W
C1	4 uF 450 V electrolytic
C2	47 uF 20 V electrolytic
C3, 4	.1 uF 25 V disc
CR1, 2	1N4006
CR3, 4, 5	1N914
CR6	1N4742 12 V zener diode
SCR	2N2328
F1	Fuse holder and 25 Amp fuse
U1	LM 311 IC
SW1	SPST N.O.
SW2	SPST N.C.
NE1	Neon lamp and holder
K1	Relay 110 V coil, 25 Amp or 30 Amp contacts DPDT
T1	Differential transformer
PC311	Printed circuit board
Chassis box	5" X 6" X 9"steel box with handle

The following are available:

GFI kit	110 V	type 311-K	$55.95
	220 V	type 312-K	$65.95
Assembled GFI	110 V	type 311	$70.95
	220 V	type 312	$80.95

(all above plus $5.00 shipping and handling)

PC board	$10.00 ppd
Relay	$16.00 ppd
Transformer T1	$13.50 ppd

To order, send check or money order to: LOTRONICS, PO Box 975, El Cerrito CA 94530 (allow 3-4 weeks for delivery).

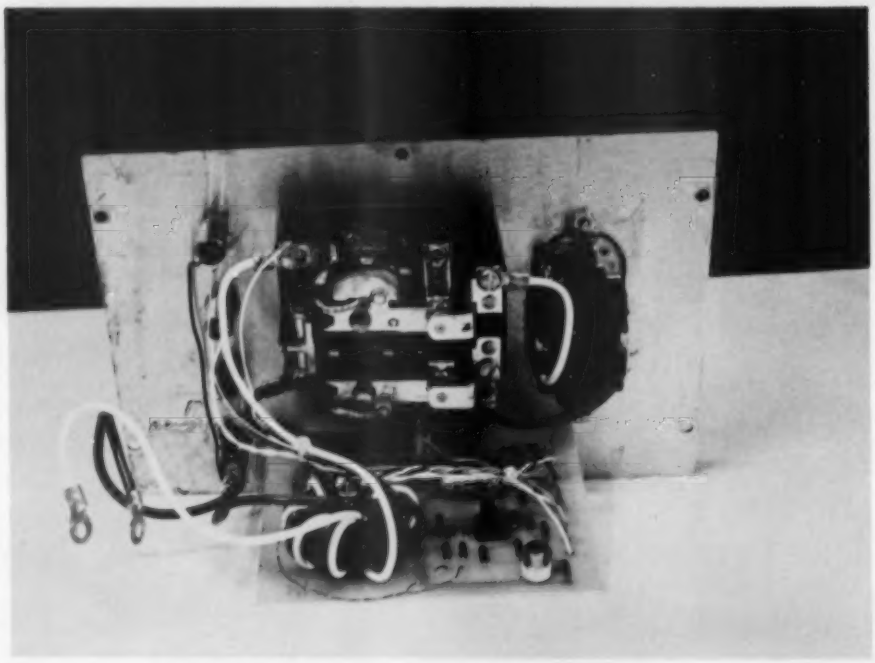

Photo B.

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3600A	$199.95	50Hz - 600MHz	Oven .5 PPM 17° - 37°C	10MV	10MV	50MV	8	.5 Inch	115 VAC or 8.2 - 14.5VDC	2¼"H x 8"W x 5"D
3550W	$149.95	50Hz - 550MHz	TCXO 1 PPM 65° - 85°F	25MV	25MV	75MV	8	.5 Inch	115 VAC or 8.2 - 14.5VDC	2¼"H x 8"W x 5"D
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Why, then, do so few hams have them? "Well, my keyer is an oddball design; I don't have access to a free-running oscillator in order to synchronize it to the memory"; or, "I just use a straight key."

I had the same objections, but at the 1977 Field Day, a friend in my club, Elmer Watts KØHAO, told me that he had designed a memory that would work with any keyer—even a straight key! I was so delighted with my version of his design that I asked for permission to write it up. This is the result.

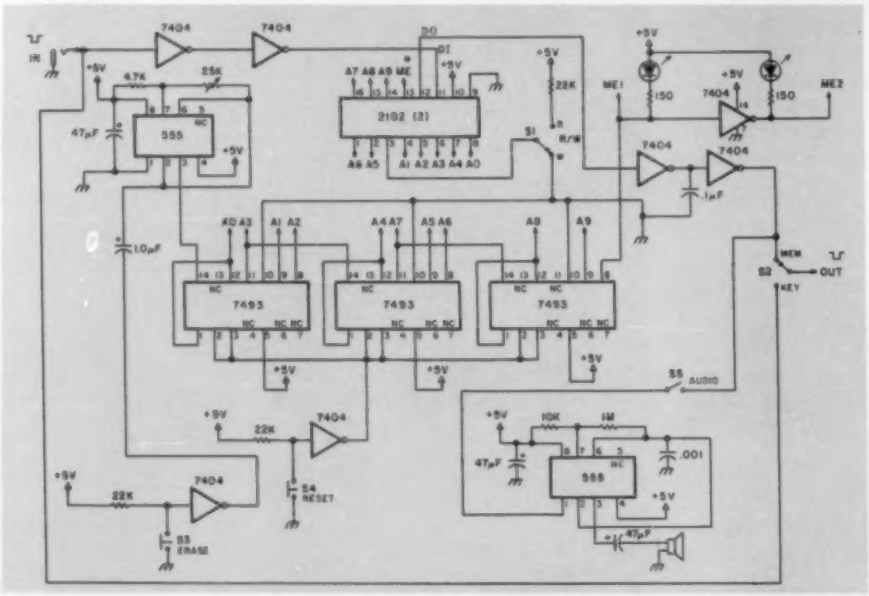

Fig. 1. The basic circuit.

Most of the previous memories were designed to work with only one keyer or type of keyer, as the two had to be synchronized. That is, the oscillator on the keyer had to be exactly in step with the oscillator on the memory in order for a dot to be stored in one memory location and a dash in exactly three. One got perfectly-spaced CW out of such a memory, but it was tricky to build. What makes this memory unique is that you don't have to synchronize it with another oscillator.

The secret of this memory is in clocking it at a much higher rate than the keying speed. Dits are then stored in a number of memory locations, not just one, and dahs are stored in approximately three times as many locations as are the

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dits. Running the memory in such a fashion destroys the perfect 1 to 3 ratio of a well-adjusted keyer, but the output of the memory is so close (1 to 2.9 or 3.1) that even the most critical ear can't tell the difference. The memory space certainly is not used in the most efficient way, but the advantage is that it can be used with nearly all keyers, bugs, straight keys, or sideswipers.

The basic circuit is shown in Fig. 1. It is straightforward and unbelievably simple. The heart of the circuit is two 2102 1K x 1 static RAM memory chips, for a total of 2K or 2048 bits of memory. They are wired up in parallel, pin for pin, except for pin 13, the memory-enable pin. More on this later.

A 555 timer is wired up in the astable multivibrator mode and clocks three 7493s, which are 4-bit binary counters. The speed of the clock can be varied by means of the 25k pot. The 7493s provide the ten address lines needed to address the 2102s ($2^{10} = 1024$ bits per chip). As we said before, the 2102s are in parallel except for the ME pins, because we want to enable only one chip at a time. (A logic 0 on the ME line enables the chip, while a logic 1 disables it.) This is accomplished by using an inverter section connected to pin 8 of the last 7493. In the starting position, where A_0 through $A_9 = 0$, ME1 will be low, ME2 will be high, and the first memory chip will be enabled. 1024 bits later, the first chip will have been addressed fully. Pin 8 on the 7493 will then switch high, ME1 and ME2 exchange logic levels, and the second memory chip will be enabled. In this way, both chips are used to their full capacity. The LEDs are there to give visual indication of when one memory has been cycled through and the other is starting.

Incoming data to the 2102s is fed through two inverters to pin 11 and can be keyed by any method in which key-down is represented by a logic 0. Although the two inverters look redundant, they are there for a reason. The DI pins tend to assume a low state if left floating. Since logic 0 = key-down in this circuit, this can't be tolerated; the two inverter sections are there to pull the DI pins high in the absence of an incoming signal.

Data-Out is available at pin 12. The two inverters and the capacitor following it are for shaping purposes. A switch, S2, is provided to allow the operator to choose between using the message stored in memory or using the key without going through the memory. Note, also, that the output drives a sidetone oscillator, another 555 in the astable mode. A switch, S5, is provided to shut off the audio tone when the memory is not in use. S4, the Reset switch, resets the memory to the starting point by bringing all the address lines to logic 0. S1, the Read/Write switch, controls whether or not data is written into the memory or is available at the output. The Erase switch brings one end of the 1.0-uF capacitor up from ground to a logic one when pushed, allowing the 555 clock to run at its top speed, around 200 kHz. The memory chips cycle through in just a fraction of a second, and if the Read/Write switch is in the Write position, it will clear the entire 2K of memory.

It should be noted that this diagram does not provide a way to key the transmitter, as different transmitters use different keying methods. Circuits for keying the two most popular types of transmitters (grid-block and cathode-keyed) are shown in Fig. 2.

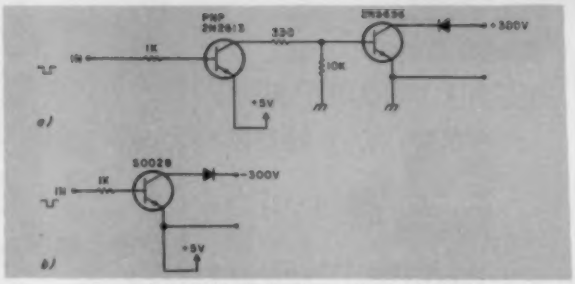

Fig. 2 (a) Cathode keying. (b) Grid block.

Construction can be as simple or as elegant as you desire. A well-regulated 5-volt supply should be used with adequate filtering. I have added 47-uF capacitors across the supply to the 555s; these should be placed as close to the 555s as is physically possible. 555s tend to generate a lot of garbage and glitches, and extra bypassing is needed to prevent these from being sent on down the line. Bypass capacitors on the order of .01 or so should be placed across the supply near all the rest of the chips, also; this is simply common sense when working with TTL and was not shown on the schematic.

As seven inverter sections are used, two 7404 chips are required. Any unused sections should have their inputs tied to ground.

The easiest way to parallel the two 2102s is simply to stack one on top of the other and solder the pins together. While it is surprising how much heat they can stand, don't overdo it; try to use a small soldering iron and solder quickly. Remember not to solder the ME pins together.

If one desires control over the pitch of the sidetone oscillator, the 1-megohm resistor on the 555 can be replaced with a trimmer pot.

Operation is simple. Turn the Memory/Key switch to the Memory position, turn the Read/Write switch to the Write position, turn the Audio switch on, reset the memories, and key in the message you want. When you're finished, switch the memory back to read and reset it. Your message should play back.

If the message is distorted, this means that the memory clock is not running high enough as compared with the keying rate. Either advance the clock rate or slow down your fist, and try again. Eventually, you will find a speed fast enough so that the message is recorded undistorted. The memory should be running as slow as possible, without distortion, in order to get a longer message into memory. Of course, once the message is in the memory, you can play it back at any speed you wish by simply varying the memory clock speed. Maybe this accounts for some of the 60 wpm plus signals we hear on the air!

Total cost for this memory is ridiculously low, with the most expensive components being the five switches. The 2102s are available nearly everywhere for under $2 each, 7493s under a buck apiece, 555s for 50 cents, and the 7404s for the whopping sum of a dime per chip. It really is a poor man's memory!

I hope you like the memory as much as I did. I'll be glad to answer any and all questions if you send me an SASE.■

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What is there to do about it? You could, of course, keep the engine running while you are operating, but that wastes gas if you are not in motion. A better solution is to connect your radio equipment to an auxiliary battery—a separate battery that is charged by the alternator when the engine is running, but is disconnected and isolated from the main or starting battery when the engine is stopped. That way, you can run the auxiliary battery down even to the point of total discharge, with the main battery remaining charged and ready to start the engine.

Furthermore, there is a wide variety of electrical appliances, ranging from refrigerators to bed warmers, that can enhance the comfort of living in a van or camper. Again, you can get the most out of these conveniences only if you don't have to worry about running down the starting battery. Large motor homes and other recreational vehicles are all equipped with auxiliary batteries. They are available as optional equipment in some makes of vans and in most makes of pickup trucks. One can be added, using aftermarket components, to any vehicle that has room for an extra battery.

As a point of reference for the following discussion, Fig. 1 shows a simplified view of the normal car or truck electrical system, specifically, the part devoted to charging the battery. You can see how the alternator provides power to the vehicle circuits and charges the battery through the ammeter. The alternator field is supplied by the regulator, which receives power through the ignition switch and senses the voltage that it receives.

To install an auxiliary battery, you must first find room for it. Some vans and most pickup trucks have room under the hood. For these, battery trays are commercially available for about $10. Some cars might also accommodate an extra battery under the hood.

If there is not room under the hood, you can install the battery in the trunk of a car or under a bed or within a cabinet in a van. The space occupied by the battery should be vented to the outside to prevent accumulation of the hydrogen gas given off by the battery when it is being charged. Plastic battery boxes are available at trailer supply stores. These are useful for protecting the battery and for keeping battery acid off other things.

You must, of course, have a battery. An ordinary car battery will do nicely and is commonly supplied when an auxiliary battery is ordered with a new vehicle. However, it is not optimal for this application. An ordinary car battery is designed for so-called "floating" service, where it is kept continually at or near full charge by the alternator and only dis-

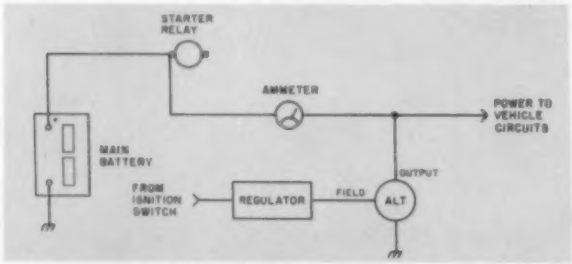

Fig. 1. Simplified circuit of automobile electrical system.

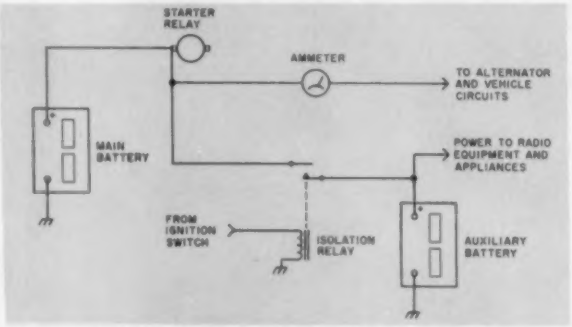

Fig. 2. Auxiliary battery with relay isolator.

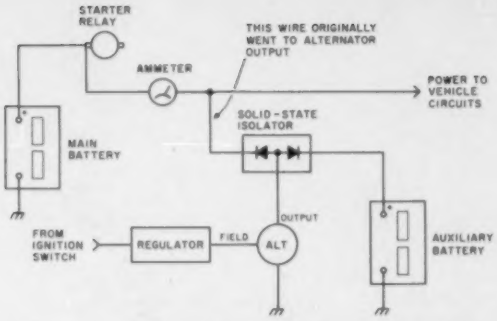

Fig. 3. Auxiliary battery with solid state isolator.

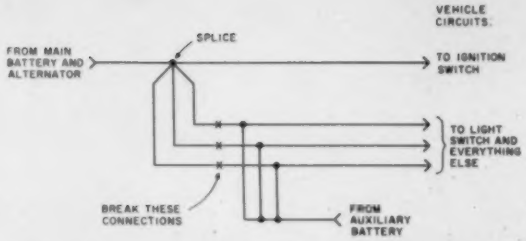

Fig. 4. Powering vehicle circuits from auxiliary battery.

charges a small fraction of its capacity by the normal engine start.

An auxiliary battery, in contrast, is subject to so-called "cycling" service, where it may discharge a large fraction (or all) of its capacity, if not completely, when electrical equipment is used with the vehicle and the engine off. (The discharge and subsequent recharge by the alternator constitute a "cycle" in battery parlance.) This sort of service is hard on a battery and hastens its deterioration by such occurrences as the shedding of active material from the plates. A battery that is designed for cycling—say, a marine battery such as the Sears Die-Hard Marine—will cost more than a car battery, but will last longer in this type of service.

The final item you will need is an isolator, whose function is to disconnect the auxiliary battery from the main battery when the engine is not running. This is available from recreational vehicle supply stores. Be sure to get an isolator with a current rating equal to or greater than the output rating of your alternator.

There are two types of isolator—relay and solid state. The relay isolator is the cheaper of the two, so (naturally) it is always used when the auxiliary battery is put on the vehicle at the factory. A diagram of the arrangement is shown in Fig. 2. It consists simply of a contactor relay (looking something like a starter relay) that connects the auxiliary battery in parallel with the main battery when the ignition is on. The auxiliary battery then receives a charge. When the ignition is off, the relay opens and the auxiliary battery is isolated.

This is a workable arrangement, but it has three disadvantages. First, if the load on the auxiliary battery while the engine is running exceeds the alternator capacity, current will be drawn from the main battery. Second, if the two batteries are at different states of charge, heavy currents will flow from the stronger one in to the weaker one when the ignition is turned on. Finally, the relay contacts are subject to deterioration.

The solid state isolator avoids these disadvantages. As purchased from a recreational vehicle supply store, it looks like a very mysterious box with cooling fins on the outside and the internal workings inaccessible. It costs about $25. However, as shown in Fig. 3, all there is to it is a pair of high-power diodes mounted on a heat sink. The anodes of the diodes are both connected to the output terminal of the alternator, while the cathodes are connected to the two batteries. Thus, current can flow from the alternator to both batteries, but not from one battery to the other. The regulator continues to sense the voltage of the main battery and thus compensates for the diode drop.

You can save a little money by making your own isolator. Simply procure two diodes with current ratings equal to or greater than your alternator output rating. The lowest voltage rating offered, commonly 50 volts, is adequate. Mount them on a heat sink (with adequate insulation of course) and hook them up.

To install the solid state isolator, find a place to mount it near the alternator. Remove the heavy wire from the alternator output terminal and connect it to one side terminal (i.e., one diode cathode) of the isolator. (This wire will carry charging current to the main battery.) Prepare a new heavy lead and connect it between the alternator output terminal and the center terminal of the isolator (i.e., the two diode anodes). Connect the remaining side terminal to the auxiliary battery.

Whenever you do any electrical installation work of this type, it should go without saying that you first disconnect the ground cables from both the main and auxiliary batteries. Otherwise, expensive fireworks will occur.

Use number 10 or heavier wire for the power connections between the alternator, isolator, and batteries. A kit of crimp-type terminals is extremely useful for this sort of job.

Once you have an auxiliary battery, you can get a lot more benefit from it by rewiring the vehicle electrical system so that the lights and other accessories are connected to the auxiliary battery, and only the items controlled by the ignition switch remain connected to the main battery. That way, you won't have to worry about running down the main battery if you leave the lights on, either inadvertently or for safety, or if you plug something into the cigar lighter socket on the dashboard.

Because of the wide variations in the details of car and truck electrical systems, I can present only general guidelines for making this change. See Fig. 4. Start by studying your vehicle's wiring diagram. Look for a splice where the main power wire from the battery, ammeter, and alternator branches out to the ignition switch, light switch, and other accessories such as the cigar lighter (possibly passing through the fuse box on the way). Cut all wires away from this splice except the ignition switch wire and the feed wire from the battery. Connect the wires you have cut loose to the auxiliary battery.

Normally, vehicles with auxiliary batteries have not been wired in this way. (My van is probably the only one until this article appears.) Making the change will, in all likelihood, involve you in working with the tangle of wires under the dashboard, but the results are well worth it.■

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Quite a few repeaters around the country are using the K2OAW repeater control and CW identifier published in *73 Magazine*, February and March, 1973.

The identifier used a simple diode matrix for memorizing a call consisting of up to 32 dits, dahs, and spaces. That was sufficient even for long repeater calls such as WR2XXX. But the FCC

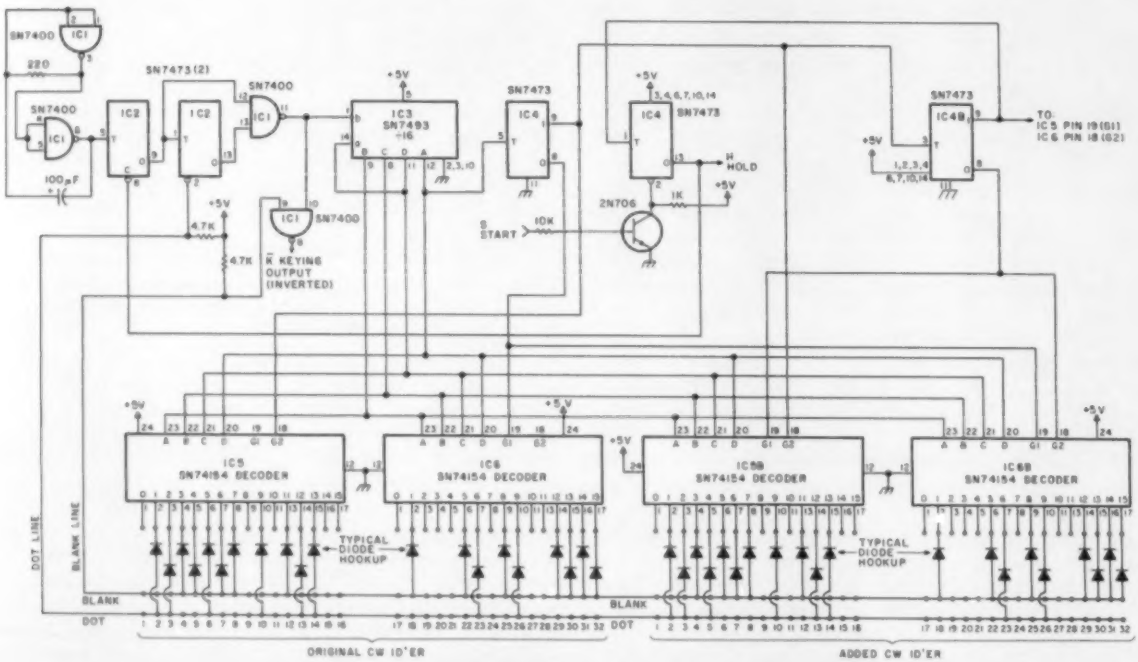

Fig. 1. CW identifier as modified for 64 diode positions.

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recently changed the rules—no new WR calls will be issued and individual calls followed by /RPT are to be used. Now, even a simple call such as K2EEE/RPT is too long to fit into the 32-bit limitation.

Snort of designing a completely new identifier, the easiest solution for repeaters which must change to the new call system is to simply add three new TTL integrated circuits as shown in Fig. 1.

The three new ICs are IC4B, IC5B, and IC6B. IC5B and IC6B are connected exactly the same as IC5 and IC6 on the original board and extend the diode matrix to 64 bits. Diode matrix wiring is exactly the same as before, with diodes scanned from left to right.

IC4B is a new flip-flop which is connected between the two halves of the old IC4 to extend the counter from 5 bits (which would access 32 diodes) to 6 bits (to access 64 diodes). The wiring to the G1 (pin 19) and G2 (pin 18) inputs to all four 74154 decoders is now different.

The new ICs and diodes can be installed on a perforated board which connects to the original printed circuit board with 11 wires, counting +5-volt power and ground. I also have several of the original identifier boards, which I will be happy to sell ($7 each) to anyone who would like to mount the new board piggyback above the old one.

So, if you have to change your repeater's call, go ahead and make this modification. It's a lot easier to modify the present identifier than to start all over. ■

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102	.96	165	6.95	222	1.99	291	1.99
102A	.98	171	1.37	223	2.75	292	2.26
103	1.05	172A	.72	224	5.06	293	1.98
103A	1.11	175	1.62	225	4.34	294	1.14
104	1.06	176	2.06	226	1.67	295	2.02
105	3.27	177	.49	228	1.38	297	1.13
106	.80	179	5.69	229	1.06	298	1.13
107	.79	180	5.88	230	3.60	299	2.02
108	.79	181	4.65	231	3.96	300	2.02
121	2.15	182	3.35	232	.75	302	2.80
123	.69	183	3.63	233	.74	306	2.80
123A	.79	184	1.37	234	.72	307	2.57
124	1.53	185	1.70	235	2.45	308	7.85
126	1.16	186A	1.48	236	5.75	309K	3.27
127	4.80	187A	1.46	237	9.07	310	7.85
128	1.37	188	1.59	238	7.95	311	2.13
129	1.58	189	1.59	239	3.02	312	1.13
130	1.80	190	1.85	241	1.71	313	1.00
131	1.98	191	2.07	242	1.90	314	7.85
132	1.01	192	.98	276	6.72	315	2.01
133	1.14	193	1.04	278	2.36	316	2.74
152	1.43	194	.83	279	5.85	317	24.20
153	1.85	195A	2.67	280	5.06	318	20.60
154	1.85	196	1.98	281	6.35	319	1.11
155	2.02	197	1.89	282	4.24	320	26.00
157	1.43	198	1.89	283	6.32	321	7.85
158	1.08	199	.59	284	7.35	322	1.80
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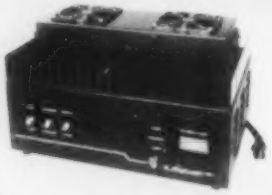
Mounting	Bench Mounting, Rubber Bumpers Rack Mounting, 19" Adaptor Kit (OPTIONAL)
Connectors	SO-239-UHF
USA Price	$895.00 FOB Factory, Fan Kit $59.00



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CA 3079	2/1.00	2000	6.8 V @ 1W	10/1.00	2000
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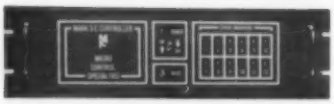

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A58

Reader Service—see page 195

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Microcomputer Interfacing

from page 14

programs back into memory. In any case, when errors are found, you will probably want to reedit and reassemble the software to produce a complete, error-free, documented listing.

Since most programs will contain errors, it may be a good idea to have the debug program as a permanent part of your computer. The storage of a debug-type program in read-only memory (ROM or PROM) is wise since "runaway" programs being tested might alter the debug software, causing you to have to load it again. There are many debug or *monitor* programs available, with Intel Corporation's Insite software library listing at least four. The editor/assembler programs may also be resident in PROM, and the low cost of both read/write memory and PROM chips suggests that many users will keep standard system programs such as editors, assemblers, and debug resident in their systems. The alternative is a paper tape, cassette, or disk-based software package which must be read into memory before each use.

There are also cross-assemblers which will generate an assembled program, but for some other computer. For example, a PDP-11 might be able to cross-assemble 8080 microcomputer programs. Cross-assemblers can be powerful programs, since some incorporate simulation programs to test the program, too.

The program we use for testing programs is DBUG written by Dr. Chris Titus,* and the assembler output shown in our program examples is that produced by the Tychon Editor/Assembler (TEA). Both are resident in our 8080 system on PROM chips.

*"DBUG, An 8080 Interpretive Debugger," Titus, C.A., E & L Instruments, Inc., Derby CT 06418, 1977.

Contests

from page 18

band at the same time.

EXCHANGE:

OM stations send RS(T) plus 2 digits denoting the operator's age; YL stations send RS(T) plus 00.

SCORING:

For non-Asian stations: Score 1 point per Asian QSO; multiplier is the number of different Asian prefixes worked on each band according to WPX rules. Asian stations score 1 point per non-Asian QSO; multiplier is the number of different countries in the world worked on each band according to the DXCC countries list.

Note: JD1 stations on Ogasawara (Bonin and Volcano) Islands belong to Asia. JD1 stations on Minamitori Shima (Marcus) Island belong to Oceania. Contacts among Asian stations and among non-Asian stations will not count for QSO points or multipliers. Contacts with KA stations are not eligible! They are considered not amateur, but military!

ENTRIES AND AWARDS:

Please use official contest log and summary sheets or other similar forms. Please keep all times in GMT and fill up the blanks of "multiplier" by the countries or prefixes only the first time on each band. A number of awards will be issued depending on the number of entries from each country in each class. Disqualification may result for violation of the contest rules, false statement in the report, or taking points for duplicate contacts on the same band in excess of 2% by the total. The log and summary sheet must arrive together at JARL, PO Box 377, Tokyo Central, Japan, on or before the following dates: phone—September 30th; CW—November 30th. You may have contest results by enclosing one IRC and SAE with your log.

WEST VIRGINIA QSO PARTY
Starts: 2300 June 16
Ends: 2300 June 17

All amateur radio operators are invited to participate in this year's party sponsored by the West Virginia State Amateur Radio Council. The same station may be worked on different bands for additional points. Only one contact with each station per band may be counted for scoring. West Virginia stations may work each other.

EXCHANGE:

QSO number, RS(T), and WVA county or state/country.

SCORING:

Out-of-state stations multiply the number of eligible QSOs with WVA stations by the number of different WVA counties worked. This total is then multiplied by the power multiplier indicated below. WVA stations multiply the number of eligible QSOs by the sum of the different WVA counties, states, and countries worked. This total is then multiplied by the power multiplier: dc input of 200 Watts or less, multiply by 1.5; dc input of 201 Watts to legal limit, multiply by 1.0.

ENTRIES & AWARDS:

To be eligible for an award, a station may have only one unassisted operator and logs must contain a minimum of 50 valid contacts (20 for Novices). Logs must be received no later than July 15th and logs will not be returned. Logs must indicate the date, time, QSO number, callsign, their QSO number, signal report, and county/state/country or station worked, mode, and band. Awards will be issued as follows: highest-scoring WVA resident, 1st runner-up WVA resident, 2nd runner-up WVA resident, highest-scoring Novice WVA resident, highest-scoring station from each state, highest-scoring station from each country, and highest-scoring Novice from each state. Decision of the Contest Committee of the WVA State ARC will be final. Logs should be sent to: West Virginia QSO Party, PO Box 36, Seneca Rocks WV 26884. Suggested operating frequencies are 35 kHz inside each CW band and 10 kHz inside the general portion of each phone band.

7-LAND QSO PARTY
Starts: 1200 GMT June 30
Ends: 2400 GMT July 1

This is the second annual QSO Party sponsored by the NAS Whidbey Island ARC. The 7-land area includes the 8 US call district states, the VE7 call area of Canada, and the KL7 area of Alaska.

Operating time is limited to 30 of the 36 contest hours. The same station may be worked on each band, and contacts between 7-land stations are permitted for multiplier and QSO credit.

EXCHANGE:

All stations: RS(T)/contact no. /state, province, or country. 7-land stations include county.

SCORING:

One point per QSO for 7-land stations. Five points for each 7-land contact for all other stations.

Multiplier: 7-land—one multiplier for each of the 50 US states and 13 Canadian provinces on each band. All others—one for each state or province worked in the 7-land area, maximum 13 on each band.

Power Multiplier: 5 Watts or less—x5.00; 5 to 100 Watts input—x2; 100 to 299 Watts input—x1.5; 300 to 499 Watts input—x1.25; over 500 Watts input—x1.

Final score is QSO point total x sum of band multipliers x power multiplier.

AWARDS:

Certificate to each top-scoring single op in each state, province, and DX country.

Certificate to each top-scoring multi-op, single transmitter in each W/VE call district.

There will be no multi-multi category.

All stations operating outside the call district indicated by their call must sign portable.

LOGS:

Logs must show band, mode, date and time in GMT, station worked, exchange sent and received, points.

Use a separate sheet for each band and include a dupe sheet if your entry includes over 100 contacts.

Make your own log and dupe sheets. However, a summary sheet can be obtained from WB7NVM if an SASE accompanies the request.

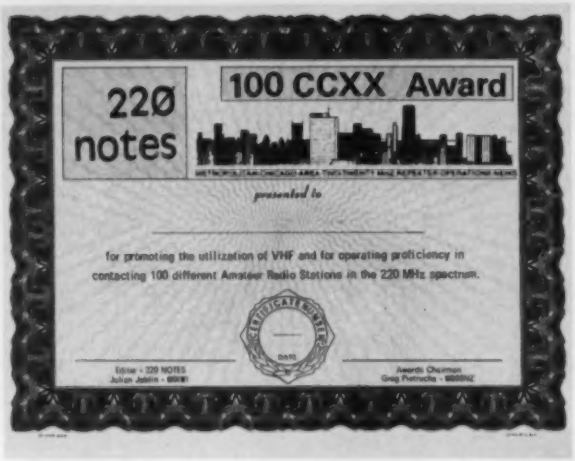
Include an SASE with the entry. Mailing deadline is August 1, 1979. Mail entries to: NAS Whidbey Island ARC, c/o Lloyd Vancil, 3541 Appian Way, Oak Harbor WA 98277.

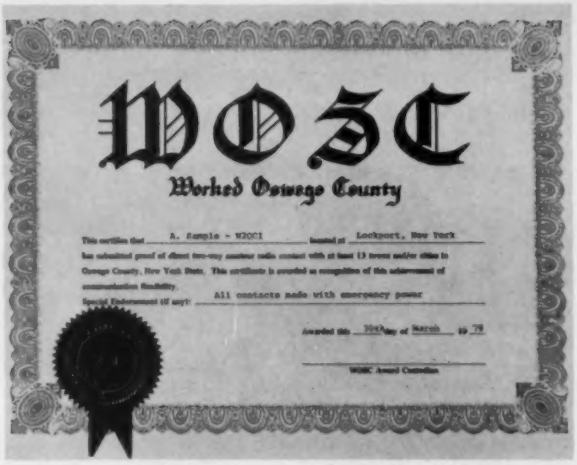
220 NOTES—100 CCXX AWARD

An attractive certificate is awarded to amateur radio operators who contact 100 separate stations anywhere in the 220-MHz band *after* receipt of the official logsheets. Contacts may be made through any repeater or via simplex. Please keep a dupe sheet to avoid disqualification caused by duplicate entries. Logs may be obtained from WB9SNZ; include an SASE. Completed logs should be mailed with $1.00 to *220 Notes*, to: Greg Pietrucha WB9SNZ, 2216 N. Kildare Avenue, Chicago IL 60639.

THE WORKED OSWEGO COUNTY AWARD

The Worked Oswego County Award (WOSC) is available to any amateur radio operator who works amateur radio stations in at least 13 of Oswego County's 24 towns and cities. A gold-seal endorsement is available to those who work all 24 cities and towns.


220 notes
100 CCXX Award
presented to
for promoting the utilization of VHF and for operating proficiency in contacting 100 different Amateur Radio Stations in the 220 MHz spectrum.



All direct two-way contacts (made without the aid of a repeater) made after January 1, 1978, count toward the award. All contacts must be made from the same station at the same fixed location, or, if mobile, from within five miles from the licensed location. Contacts with all fixed or mobile stations count on any amateur band. Multiple contacts with the same station portable or mobile in a number of town or city locations is permitted for the purpose of making additional town or city contacts.

A special endorsement is available if contacts with all cities or towns are made using emergency or battery power.

Applicants should list the time, date, frequency, mode, and power used, along with station contacted and location (town name or city). This is the usual information that would be filled in on the standard ARRL log. The list of 13 or 24 contacts should be mailed to the Award Custodian along with a self-addressed, stamped return envelope. QSL cards are not required, but the spot log check requests to the stations listed may be made by the Award Custodian.

There is no charge for this award. The award is sponsored by radio station WOSC to encourage contact with all areas of Oswego County and test station capabilities. The rules and qualification specifications may be changed from time to time by the Award Custodian. In the case of questions and disputes, the decision of the WOSC Award Custodian is final. The Fulton Amateur Radio Club will act as custodian for the award. Its mailing address is: PO Box 246, Fulton NY 13069.

Official WOSC List of Oswego County Towns and Cities

Oswego Town	Richland
Hannibal	Sandy Creek
Granby	Boylston
Minetto	Orwell
Scriba	Albion
Volney	Parish
Schroeppel	West Monroe
Palermo	Constantia
New Haven	Amboy
Hastings	Williamstown
Mexico	Redfield
City of Oswego	City of Fulton

Looking West

from page 6

operator assigned the callsign indicated hereunder. I actively operate in the presently-allocated 220-MHz amateur band, using my own equipment and through repeaters representing substantial investments of cash and technological effort.

In a portion of Docket 20271 (Par. 103 and 124) concerning its position to WARC on frequency allocations, the Commission proposed that the present 220-225-MHz amateur radio frequencies be allocated primarily to a new use by the maritime radiotelephone service.

I am not aware of any Notice previously issued regarding this proposed allocation. This portion of the Report and Order clearly affects my rights and the rights of other licensed amateur radio operators to the 220-MHz band. A formal opportunity for amateur radio response would demonstrate that the 220-MHz band is in active use throughout the United States, presenting an attractive alternative to the crowded 2-meter band.

Growth of "220" had previously been restricted by the threatened allocation of the frequencies to Citizens Band use. However, since the Commission denied that proposal, amateur use of the band has flourished.

I join with the 220-MHz Spectrum Management Association of Southern California in its petition to withdraw the affected parts of Docket 20271, and to set that matter for comments and hearings in an appropriate framework as required by law.

Respectfully submitted,

/s/

Date:
Name/Call:
Address:
City/State:

Thanks to *220 Notes*, here is an easy way for you to join in the fight to save 220. Lee Knirko W9MOL and Julian Jablin W9IWI, who prepared the special "Action" bulletin, suggest that you do one of the following with the letter:

1) Make one copy and 14 photocopies, and send all 15 to the Secretary of the FCC in Washington; or

2) Send just one copy to the FCC (which will at least put you on record as opposing the US 220 WARC proposal, although it will not be considered an official reply by the Commission); or

3) Look over the points made and draft a letter in your own words to the same effect. This is the best method, although it takes the most time. Then go out and again make 14 photocopies and send all 15 to the Commission as your official reply; or

4) If you do draft your own letter but do not have the time to copy it, at least send it to the FCC as fast as possible.

The idea here is for the amateur community to show its support for the one lone Petition for Reconsideration on this matter which was filed on time. Without such support, the 220-SMA has little chance of accomplishing much. With your support, the FCC will be forced to take notice.

Lee and Julian also suggest that you send copies to your senators and representatives, as well as to Dave Sumner at ARRL HQ. I might also suggest that copies be sent to the 220-SMA of Southern California, to the Westlink Amateur Radio News Service, and to myself.

THE CB BANDITS DEPARTMENT

Abuses of CB operation were given a good look on the morning of April 5th on the National Broadcasting Company's "Today" program. In a segment entitled "CB Bandits," produced at NBC's Burbank facilities by Scott Goldstein, NBC correspondent Jack Perkins explained to the public the myriad of problems now prevalent on the 11-meter Citizens Band by visually documenting many of the more common abuses in the CB service.

Shown were such regulatory violations as the use of excessive power, DXing, and even the playing of music on 11 meters. In the case of the latter, a female CB operator in the midwest was shown running an on-the-air CB music program from taped cartridges through her CB set and linear amplifier. Other scenes depicted how "CB bandits" who run excessive power make life miserable for both the legal CB operator (who wishes to use 11 meters for its intended purpose) and his neighbors, in the form of excessive TVI and BCI. The FCC was given its say on this problem through Los Angeles Engineer-in-Charge Larry Guy, who stated that such operations were indeed illegal and noted that if all CB operators obeyed the regula-

tions, there would be no need for amplifiers and the like. The report showed the FCC's enforcement operation here in southern California, but explained that although the FCC attempted to keep control over CB, it was hampered in this due to a lack of staff. It gave a figure of 400 FCC employees nationwide who were trying to police more than 15 million CB operators.

Perhaps the most vivid portion of this 5-minute, 30-second segment was mini-cam coverage of a business in Costa Mesa, California, known as Pacific Coast Communications, which the report alleges to be a supplier of illegal power amplifiers and similar equipment. To radio amateurs, this particular piece has important significance in that it visually gives credence to what many amateurs have said for a long time —that the FCC's linear amplifier ban on such devices operating in the spectrum from 24 through 36 MHz is nothing but a bureaucratic farce which punishes the law-abiding amateur for the sins of another radio service. The ban has accomplished only one thing: It has created a rather healthy black market for such equipment. I suspect that operations such as PCC are more the rule than the exception. Maybe the contents of the "Today" report will get through to the Commissioners the fact that their "easy way out" was not the right road to follow after all. The inability of the FCC to cope with the CB problem won't be easily forgotten.

Whether they realize it or not, the "Today" program producers have performed a service for amateur radio. They did not lump amateur and CB operations together (as is often done by the broadcast media), and they graphically pointed out the real world of CB and the problems it faces today. Moreover, they may have given amateurs the kind of ammunition needed to shoot down the unconstitutional, unwarranted, and illegal ban on 10-meter amplifiers.

COMMENTARY

The NBC report neglected to mention one important item—that the problems depicted were big-city ones not often found in the outlying areas. Los Angeles CB operation is a mess. It's virtually impossible to hold a QSO of any consequence because of the many CB bandits like those depicted on "Today." This holds true for most cities of any size. However, once you get away from the big cities, things are quite different; the CB bandit is definitely a minority figure in such locations.

One other point missed by the NBC presentation was the difference between AM and SSB operation. Only unstructured AM was shown, which in big-city CB is a no-man's-land. Not mentioned were some of the structured and voluntarily-policed SSB operations. However, it is hard to really criticize this report on either of these points, since the obvious aim was to enlighten the public about the current problems of 11-meter CB. Considering the constraints imposed by the exact timing that TV broadcasting requires, I must say that NBC has done a rather outstanding job.

* * *

In a late-breaking development, the FCC acted the week of April 1st to deny the 220-SMA Petition for Reconsideration of Docket 20271. The FCC based its denial of this and eight similar petitions on the grounds that over four years had been spent on the preparation of the WARC proposal and that, during that time, all interested parties had been given ample time to comment. However, it must be noted that during this four-year period, not once was there a mention of reallocating 216 through 225 MHz to the maritime service and, therefore, there was no way in which concerned amateurs could comment on the matter. Many 220-MHz amateurs feel that both the maritime service and the FCC have directly violated the federal government's Administrative Procedures Act and stand ready to take whatever legal action is necessary to prevent the implementation of the WARC proposal.

RTTY Loop

from page 20

tions with special data, these characters can be used as software switches to accomplish special functions. The special codes detailed above, for example, translate to:

$00—The null is stored for control codes which have no function in Baudot, e.g., $01, $02, $1F, but not those with a function, as the BELL ($07).

$FF—A DEL is stored for certain "special" printable characters not found on the Baudot keyboard.

$FE—Stored at the first location of the table, $FE will be sent as LTRS when a NULL is input from the keyboard.

After the table value is retrieved, it is tested for $FF, and, if present, a branch to SPLCHR is executed. This routine handles those printable characters, like *, %, and @, that are not represented in Baudot. Another test for $00 directs a branch back to the input if present. Thus, control codes do not even start the outputting routine.

If there is no "special case," then the Baudot output sequence is initiated. The MSB of the data retrieved from the table encodes LETTERS or FIGURES case. The routine diagrammed in Fig. 3 shows how the shift is read, compared with the current case, stored, and changed if necessary. It should be noted that SPACE, CARRIAGE RETURN, and LINE FEED are all sent as lowercase (LTRS) characters. Thus, downshift when spacing or when sending a new line is ensured.

Having established the shift, the actual character is output, using the routine shown in Fig. 4. This routine loads the carry bit with the five remaining data bits in the accumulator, keeping track of the bit number with a counter. If the carry bit is a "1", a MARK is sent; a "0" sends a SPACE. START (22 ms SPACE) and STOP (31 ms MARK) bits are also appended, thus creating true TTY format.

Should you have encountered one of those "special" characters we mentioned above, a branch to SPLCHR would have brought you to a routine diagrammed in Fig. 5. Here, the original ASCII character input is retrieved from the table pointer where it was stored. If it is a carriage return, a branch to a routine called CRLFOT will send the string CR-CR-LF-LTRS-LTRS, a "standard" way of initiating a new line in Baudot, and echo a CR-LF on the terminal. Otherwise, a period (.) followed by two letters and another period fill in for the missing character. Fig. 6 shows the codes used for the ASCII characters encoded.

The flowcharts shown this month comprise an overview of a practical means of Baudot transmission with a computer.

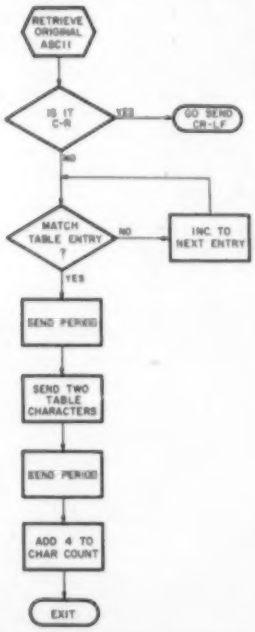


Fig. 5. SPLCHR routine.

ASCII	Symbol	Baudot
$23	#	.NR.
$25	%	.PC.
$2A	*	.AS.
$2B	+	.PL.
$3C	<	.LT.
$3D	=	.EQ.
$3E	>	.GT.
$40	@	.AT.
$5B	[	.(.
$5C	\	.BS.
$5D	]	.).
$5E	↑	.UP.
$5F	—	.UL.

Fig. 6. SPLCHR conversions.

Next month, I will go into a program to implement this scheme on an SWTPC 6800 computer. Input shall be through the control interface. An MP-S ACIA-type input is preferred, although the MP-C PIA-type board will suffice. Output shall be through one bit of a PIA board (MP-L) on port #7.

Regards this month to Melvon G. Hart W0RV in St. Louis MO. Melvon is using Teletype™ gear now, but we hope with the program now developing, and others, he will soon be able to get that SWTPC system on RTTY! He also lets us know that an active two meter RTTY net is on in St. Louis, on 146.70 MHz, AFSK. Thanks for the info, Mel.

Ham Help

I have a niece in Corpus Christi TX who is interested in becoming a ham. She is 8 years old but sharper than I in some ways. Is there a group in Corpus Christi who could help out with this project? Thanks.

Jim Falkner
Box 850
Port Saint Joe FL 32456

OSCAR Orbits

Courtesy of AMSAT

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 Orbital Information

Orbit	Date (June)	Time (GMT)	Longitude of Eq. Crossing °W
6310Abn	1	0136:46	68.6
6324Jbn	2	0141:57	69.9
6337Jbn	3	0003:54	45.4
6351Abn	4	0009:05	46.7
6365Abn	5	0014:15	48.1
6379X	6	0019:26	49.4
6393Abn	7	0024:37	50.7
6407Abn	8	0029:47	52.0
6421Jbn	9	0034:58	53.3
6435Jbn	10	0040:09	54.6
6449Abn	11	0045:19	55.9
6463Abn	12	0050:30	57.2
6477X	13	0055:40	58.5
6491Abn	14	0100:51	59.8
6505Abn	15	0106:02	61.2
6519Jbn	16	0111:12	62.5
6533Jbn	17	0116:23	63.8
6547Abn	18	0121:33	65.1
6561Abn	19	0126:44	66.4
6575X	20	0131:54	67.7
6589Abn	21	0137:05	69.0
6603Abn	22	0142:15	70.3
6616Jbn	23	0004:12	45.8
6630Jfd	24	0009:23	47.1
6644Abn	25	0014:33	48.4
6658Abn	26	0019:43	49.8
6672X	27	0024:54	51.1
6686Abn	28	0030:04	52.4
6700Abn	29	0035:15	53.7
6714Jbn	30	0040:25	55.0

OSCAR 7 Orbital Information

Orbit	Date (June)	Time (GMT)	Longitude of Eq. Crossing °W
20775	1	0002:24	64.0
20788	2	0056:41	77.6
20801	3	0150:58	91.1
20813qrp	4	0050:18	78.0
20826	5	0144:35	89.6
20838X	6	0043:55	74.4
20851	7	0138:12	88.0
20863	8	0037:32	72.9
20876	9	0131:49	86.5
20888	10	0031:10	71.3
20901qrp	11	0125:27	84.9
20913	12	0024:47	69.8
20926X	13	0119:04	83.3
20938	14	0018:24	68.2
20951	15	0112:41	81.8
20963	16	0012:01	66.6
20976	17	0106:18	80.2
20988qrp	18	0005:39	65.1
21001	19	0059:55	78.7
21014X	20	0154:12	92.3
21026	21	0053:33	77.1
21039	22	0147:50	90.7
21051	23	0047:10	75.6
21064fd	24	0141:27	89.1
21076qrp	25	0040:47	74.0
21089	26	0135:04	87.6
21101X	27	0034:24	72.4
21114	28	0128:41	86.0
21126	29	0028:02	70.9
21139	30	0122:19	84.5

Corrections

This is to express thanks to all CW music fans for corrections and suggestions for improvements for the keyboard described in the February issue of *73* ("This Station Plays Beautiful CW").

A note from KA1ADF (Speedy) arrived one day before I received my copy of *73* and pointed out: (1) The 10k resistors of Fig. 1 are not shorted out as the print indicates; (2) The callout for Fig. 2 should show 4071 for U7; and (3) U10 is a 4049. WA0KZL points out that the diodes are 1N4148, not as indicated in the callout for Fig. 1. Actually, about any diode will work. Even the cheap 1N4001 will do fine. Along with thanks to Tex goes my apology to Susan Philbrick of the *73* staff. She questioned this and I gave her a wrong answer.

W1ZB reports that he has built 20 keyboards over the years and is now going back to the diode matrix after trying many other methods. His next keyboard will use CW music logic but will replace the 40105 FIFO with the Fairchild 3341 to give a 64-letter buffer. For those who want a larger buffer, this is a good way to go.

DA1WD wants a memory for canned messages. An RCA CPD1823SD RAM interfaced between the 40105 FIFOs and the shift register ought to work. I have not made one like this, but it looks good on paper and will give 128 letters. If 256 letters are desired, a pair of CD1822SDs would do the job.

WB5RVH is on the air with an all-plastic case, using a converted UNIVAC surplus terminal and a rechargeable nicad power pack. He reports RFI problems when using the charger plugged into the ac supply. No problem without the charger. Suggest adding 0.01 uF bypass capacitors on all in/out lines. Electrolytics do a good job of filtering but are poor for rf bypass.

The worst problem of all is availability of the 40105 FIFO. This chip is made by RCA and Motorola and is available from the big houses such as Cramer, Hamilton, and Semiconductor Specialists. Unfortunately, all of these distributors have a hard-nosed $25 minimum order policy. On top of that, they often do not stock all other required chips. I was about to believe that it would be necessary to go to Japan for service when I decided to check the *73* advertisers—see Daytapro on page 183 of the February issue. Send Neil K9WRL an SASE for a quote on a chip package. He promises he will supply the 40105. By the way, if your hobby time is hard to come by, use the top line of chips. Specify RCA buffered "B" line, or equal. A typical number is CD 4071BE. After you have one keyboard working, you can test "bargain" chips easily.

Several others have written for diagrams on keying circuits and sidetone oscillators. Sorry, but I did not make drawings. I just hooked up the components per typical sketches, such as shown by VE3CW4 on page 107 in the February issue.

As hams notify me that they are on the air, I will send them a "CW Music" number. Who is going to be #3? Let's hear more CW music. Even if you don't care for a keyboard, good code makes operation a pleasure and can be sent by all methods of keying.

Russell C. W. Crom WB9WRE
904 Barberry Street
Mt. Prospect IL 60056

We would like to point out that one of our articles ("Universal Alarm Circuit," March, 1979) is very similar to one which appeared in the December 11, 1975, issue of *Electronics* ("Multiplexed detectors isolate water leaks"). F. E. Hinkle, Jr. K5PA (Austin TX) holds US patent number 4,090,193 on this device.

John C. Burnett
Managing Editor

Ham Help

I need a schematic diagram for an Electronic Counters, Inc. (ECI), Pulse Generator, Model 5101. If someone has a copy to share, I will pay for reproduction and mailing. Thank you.

Russell Steele
838 Gayle Street
Papillion NE 68046

I need a manual for a Conar Model 80 solid-state television kit. I also need any kind of information on a 1928 Model 3 Eveready ac receiver and a possible matching transmitter. Any help with these items will be deeply appreciated. Thanks.

Peter H. Oesterle VE3HOH/W3
RD #1
Orwigsburg PA 17961

I am attempting to make a list of optometrists who are amateur radio operators. Presently, I know of about 15, and I am sure there are more out there. Perhaps an informal net could be started. All QSLs will be appreciated. Thank you.

Dr. Thomas W. Byers WB9YTG
7221 W. Lake St.
River Forest IL 60305

I would appreciate any information on a 4-inch Western Electric 0-1-0 milliammeter. It has 6 terminals on the back, labeled AC1, AC2, DC+, DC−, DC±, and R.

Neil Johnson W2OLU
30 Harwich Road
South Orleans MA 02662

LETTERS

from page 13

several additional pieces of gear to the station. Not only are the products at the top of the line in features, design, and reliability, but also I have called them on two occasions for advice in application of some of the equipment and have universally been treated respectfully and promptly. On each occasion, I was referred to the amateur radio department and have found the information readily available, helpfully given and interpreted, and additional recommendations made.

The attitude and cooperation are truly exemplary. The speed and completeness of the service department is outstanding, and the basic design and presentation of the products are unbelievable. I would not hesitate to recommend this company and their personnel to anyone wishing a complete package of up-to-date equipment backed by all the technical and service expertise that could ever be needed, and all presented in a speedy, courteous, and comprehensive way.

Dr. E. Daniel Kay, Jr. K4HTY
Portsmouth VA

TURKEYS

Never in my wildest dreams would I have ever thought I'd be subscribing to *73 Magazine*. Until now, I have considered it just a cut above *Popular Electronics* as far as contents. Things like how to build a moisture detector or fuse testing made simple simply did not appeal.

Your February issue, however, has caused me to rethink my position. The article on the 8080 control system makes me feel that you may be getting around to some serious amateur projects. I did read the article, "The 2 Meter ECM Caper," and I am appalled at the fact that you could publish something tantamount to sanctioning the jamming of another amateur station. Granted, the amateur in question may have used improper or illegal methods to obtain a license, but at that time, he was still a licensed amateur.

I realize that you have to sell magazines in order to provide livings for you and your staff, but I personally feel that articles providing the "turkeys" with new ideas are not in the best interest of anyone associated with amateur radio. Lord knows, we have enough problems without causing new ones.

R. G. Wilde K6EGM
Van Nuys CA

DX

from page 22

OK3TAB/D2A is in Angola and will be there for one year. He has a beam up and is a very good operator in handling the pileups. QSL to OK3ALE.

The Northern California DX Foundation shipped a new linear amplifier to Easter Island to help boost the signal of Father Dave CE0AE. You should be hearing the results by now.

Beginning in July, EL stations in Liberia will be signing 5L for the remainder of the year.

KH3AA is a civilian on Johnston Island and is available for skeds. Write to John at Box 69, APO San Francisco 96305.

In case you have been looking for San Marino, there are eight licensed true-blue stations. These are M1B, M1BS, M1C, M1D, M1H, M1I, M1Y, and M1W. Good luck.

Liechtenstein and San Marino are often believed to be the smallest sovereign states in the world, but a mansion on the Via Condotti in Rome is probably the smallest of them all. This is the independent territory of the Sovereign Military Order of Malta. It represents an order founded during the Crusades and the order held the island of Rhodes for over 200 years. The order still issues its own passports and maintains its own diplomatic corps.

For some reason, the ARRL has refused to recognize the Sovereign Military Order of Malta as a separate country, but remember, it took the League 30 years to admit that there were two Germanys.

Here is the entire group that hoped to put VU4ARC on from the Laccadives last March. The DXpedition was well planned down to the last detail, even including medical personnel among the group, but was halted at the last minute due to tight security surrounding a visit to the Laccadives by the Prime Minister.

A new amateur in the American Embassy in Bangui has reportedly been issued the call TL8JAM. At this writing, he had no gear on hand but was awaiting shipment of some from the States. You should be hearing him anytime now.

Brother Ed HV3SJ has been sent to Colombia, thereby shutting down any regular activity from the Vatican.

QSLing for rare DX stations can sometimes be a bigger chore than ever imagined. Over 3,000 QSLs from 4U1UN went out to deserving DXers during February alone. W2MZV is now handling 4U1UN QSLs, so you can QSL direct to Herman if you desire. If you haven't snagged this one yet, look for them from Wednesdays 1900Z to 0100Z Thursdays in the 21355 kHz and 14240 kHz areas, plus or minus.

Pradhan A51PN reports that he is now handling his own QSLing. Look for him on 14005 kHz between 1200Z and 1230Z and on 14225 kHz between 1230Z and 1300Z. QSL turnaround is generally four to six weeks. Pradhan's activity has increased noticeably since the Southeastern DX Club shipped him an outboard vfo.

W1GNC reports sending back all the W0DX/Desecheo QSL requests because he never received any logs. This should not cause any problems since KP4AM/D is the only one being accepted for DXCC credit.

A station has been showing on twenty meters signing 3X1IX and saying to QSL to Box 477 there in Conakry. Some have wondered if this might be Slim. Back in 1963 there was a station signing 7X1IX, also saying to QSL to Box 477 in Conakry and also giving his name as Vlad. This station was legitimate and was operated by OK3UI, so there appears a very good possibility that 3X1IX is for real.

The Arabic Net meets each Saturday at 1900Z on 14250 kHz. Stations checking into this net include A7, A9, ST2, ST0, YK, YI, JY, and SU among others. If you need any of these for a new one, it might pay to take a listen.

LX1AG has been showing regularly twice a week on 14240 kHz at 2330Z. He says he plans to follow this pattern for some time and hopes to give a new country contact and QSL to everyone needing LX.

The ARRL has withdrawn all Sable Island credit for the operation last fall of VE1MTA, saying the station was not authorized.

K8NW wants us to let everyone know that he is not, repeat not, QSL manager for VR0M and should not be sent any more cards.

Due to a recent callsign shuffle, stations on Crete can be identified by their new SV9 prefix.

There has been a chain letter going around aimed at amateurs. All you have to do to claim untold riches, claims the letter, is mail one dollar to the proper address, then prepare twenty copies of the letter inserting your name in the proper spot, and mail them out to twenty ham friends. This chain letter is illegal because it asks for money. I wonder how it would work if, instead of money, the letter asked for blank DX QSL cards. Just think, you send one QSL to the name at the bottom of the list and a few weeks later you receive 8,000 DX QSLs ready for you to fill in your callsign. Instant Honor Roll. Actually, that kind of thing has been going on in CB circles for years.

DJ9ZB has out the latest edition of his up-to-the-minute QSL

Manager's Directory. This 6" x 8" softcover book runs to about 80 pages and is available direct from DJ9ZB for $5.00.

WB9OQU takes a list for those needing 4S7EA each Wednesday evening about 2310Z. 4S7EA shows up at 2330Z and usually stays around for about an hour. QSL to WB9OQU.

Herb Schoenbohm KV4FZ/N0VA has not backed off on his attempt to have Water Island declared a separate DXCC country. He prepared eight pages of strong support and fired it off to the DXCC desk there in Newington. Water Island remains a live issue with Herb.

FR7BP has requested that no IRCs, stamps, or dollars be sent for return postage since his mail is usually opened before he receives it and such items removed. Just send your card and he will reply via the bureau. It is usually best not to develop a habit of putting call letters on the outside of envelopes destined for overseas addresses. In some areas, this just brings unwanted attention.

D4CBS reports that plans for any S9 operation have been shelved for the immediate future. Angelo says that the possibility still exists but that the probability is just about zero.

Speaking of D4CBS, he is one of the first, along with AA6AA and W1NG, to reach the first plateau of 100 zones in the chase to earn 5BWAZ award #1.

A new DX club is being formed in the Baton Rouge, Louisiana, area. Drop a note to Jack Whitaker, 2327 Daggett Avenue, for more details.

That recent K1CO/PJ7 operation ran up 14,074 contacts in scoring some 12.3 million points. Not satisfied, they will add three more operators and try again in the CQ WW contest this fall. This will be a multi-multi operation from PJ7 and a multi-single operation from FS7. QSL K1CO/PJ7 to K3RLY.

OE6EEG along with DJ9ZB, F6BDS, and J28AZ are planning a possible upcoming effort from the Red Sea area including Abu Ail. They are exploring the possibilities of several areas and you should be hearing more on this soon.

North and South Yemen, 4W and 7O, long-time enemies, have decided it might be best for all concerned if they combined the two countries under one government. This would, of course, mean the deletion from the DXCC list of 4W and 7O and the addition of the emerging single nation. Being the opportunists they are, several DXers are already planning for the great event.

EP2LI reports that his next duty station will be in Qatar, A7, and that he plans to make every effort to reduce this one's standing on the needed lists. Mike had to abandon everything in Iran including rig, household goods, clothing, and the family bus. QSL to WA4PYF, who also has logs for A7XAH.

The Swiss Amateur Radio Magazine, *Old Man*, reported that HB9APN is at the Swiss Embassy in Peking and has been on SSB on 21155 kHz signing HB9APN/BY.

There is a feeling, going into WARC 79, by the FCC in Washington that the amateurs are lax in reporting unauthorized interference in the amateur bands. Citing the well-known Russian "woodpecker" as an example, they note that complaints to the FCC on this violation of ITU frequency allocations have dwindled to a trickle and it may be quite possible to have an assertion made at WARC 79 that the interference is nil because the amateurs themselves have stopped complaining. If you are one who has not complained because you felt the ARRL was there to protect us all and was taking care of things, then maybe you should write the League and inquire why this intrusion into the amateur bands is still going strong after more than two years. The "woodpecker" is not the only violator. The Afrikaner Net has at times been forced to shift frequency because of commercial interference. There are times when you must take matters into your own hands and quit waiting for the other fellow. The following is a full list of FCC monitoring stations and their telephone numbers. The next time you hear an intruder on the amateur bands, pick up your telephone and report it to the nearest monitoring station. Not just once, but every time.

Allegan, Michigan	(616)-673-2063
Anchorage, Alaska	(907)-344-1011
Belfast, Maine	(207)-338-4088
Douglas, Arizona	(602)-364-2133
Ferndale, Washington	(206)-354-4892
Fort Lauderdale, Florida	(305)-472-5511
Grand Island, Nebraska	(308)-382-4296
Kingsville, Texas	(512)-592-2531
Laurel, Maryland	(301)-725-3474
Livermore, California	(415)-447-3614
Powder Springs, Georgia	(404)-943-4794
Sabana Seca, Puerto Rico	(809)-784-3772
Washington, DC	(202)-632-6975
Waipahu, Hawaii	(808)-677-3954

Just because your neighbor called doesn't mean you need not call. The more reports the better.

ZS6BEE will shortly be heading out to Marion Island, ZS2MI, to relieve the present operator there. Plans call for some much needed activity after his arrival.

The FCC has extended the grace period for renewal of amateur radio licenses to five years. This means that you may regain your operator's privileges up to five years after letting your license expire without having to retake the exam. See the May *QST* for details.

A6XP, the last active station in the UAE, went QRT on February 11th and this appeared to have ended any amateur activity for the present time. The gear was confiscated and it seems the present authorities have no use for amateur radio in their country. K1DRN has been handling the QSL chores for A6XB since 1971 and has all the logs up to 0300Z on February 8th.

This may be a little after the fact, but a group of UA-types received permission to put Franz Joseph Land on the air using the call R1FJ. The operation was originally to start in mid-April, but this has been pushed back somewhat. Anyway, if you heard or worked R1FJ, you know it was FJL. If it hasn't been heard yet, then it should be at any time.

Amateur license totals at the end of January stood at 357,900 with 63,000 Novices, 68,000 Technicians, 119,000 Generals, 83,000 Advanceds, and 22,000 Extras. Amateur growth rate during 1978 was 8.4%.

RM-3317 requests that a hobby license be established adjacent to the 29-MHz band. The ARRL plans to file an opposition.

Recent check-ins to the 14225-kHz net include FB8XV, ST0RK, CR9AJ, BV2B, and KA1NC. If any of these excite your blood, try 14225 kHz from 1500Z daily. The Afrikaner Net has been drawing not only from Africa, but South America, Europe, Asia, and the Pacific areas as well. This one meets at 21355 kHz from 1830Z.

The Comoro authorities have done a sudden about-face and shut down all amateur activity. Robin D68AD has dismantled his station, taken down his antenna, and is awaiting reassignment. It appears that Comoro will be joining the United Arab Republic in a steady march to the uppermost regions of the most-needed list.

K3ZJ wrote in to point out an error in the April QSL listing. HS1ABD's QSL manager is K3EST, not W1YRC as listed. We knew that all along, guys. We just wanted to see if you were paying attention.

Carl and Martha Henson, WB4ZNH and WN4FVU, reported great conditions in making some 5,200 QSOs from the Maldive Islands, mostly on twenty with some on fifteen, but precious few on 10/40 meters. They give much of the credit to 4S7EA and his friends at Ceylon Tours as well as to 4S7JD and his wife for their generous hospitality and the fact that they were there if anything was needed. QSL to Carl Henson, 8280 Chestnut Dr., Jonesboro GA 30236. Carl notes that cards for AQ7 and HQ7 will be answered okay, but cards with incorrect date and/or time will receive biting criticism in addition to QSL. (Apparently, some stations mistook 8Q7 for AQ7 or HQ7.)

That's about all for this month. I hope some of the preceding information helps you work a few new ones. If any of you take a DXpedition-type vacation this summer, shoot a few extra pictures of your exotic surroundings and send them along, either black-and-white or color.

Thanks for much of the preceding information to the *West Coast DX Bulletin*, the Long Island DX Association *Newsletter*, and *WorldRadio News*.

NOVICE CORNER

We have been asked to remind everyone to please not send cards destined to stateside QSL managers via the ARRL Outgoing QSL Bureau. These cards wind up in that manager's envelope at the bureau and then he must pay postage on it to get his own cards from the bureau. If a QSL isn't worth the 30¢ two-way postage to the one requesting it, it sure isn't worth anything to the manager. Remember to always use GMT, also called UCT or Zulu time, on QSLs sent to managers and always include a self-addressed stamped envelope (SASE) or a self-addressed envelope and IRCs (SAE) for the manager to use in sending the DX station's QSL back.

AMATEUR RADIO IN JAPAN

The following information comes from an interview between Jan Shillington N9YL and Jun Okamura JA2BJW which appeared in the Wheaton Community Radio Amateurs, Inc., bulletin which is edited by N9YL. It should greatly increase your knowledge of conditions in Japan.

Q. How many hams are there in Japan?

A. There are 355,757 stations (CB—367,633) as of December, 1977.

Q. How many classes are there in Japan?

A. Four classes—First Class, Second Class, Novice-CW, and Novice-Phone.

Q. How many DX countries has Japan?

A. Four countries—JA, JD1 (Ogasawara Island), JD1 (Minami-Torishima Island), and JD1 (Okino Torishima).

Q. What is the Japanese zone number?

A. 25 (WW contest, etc.) and 45 (ITU).

Q. How many kinds of month-

From left to right: Ernest 4S7EA, Carl WB4ZNH/8Q7AF, Martha WN4FVU/8Q7AG, and Jay 4S7JD during Carl and Martha's recent successful operation from the Maldive Islands in the Indian Ocean.

ly ham magazines are published in Japan?

A. Three kinds—JARL News, CQ Ham Radio, *and* Mobile Ham.

Q. Can you tell me the Japanese prefixes in licensed order?

A. JA, JH, JR, JE, JF, JG, JI, JJ, JK, and JL (except JD, 8J1).

Q. What is the call area of the largest number of hams in Japan?

A. JA1 has about 41% of all.

Q. What is the call area of the smallest number of hams in Japan?

A. JA9 has about 4% of all.

Q. How much is a Drake TR-7 in Japan?

A. $1,338 ($1 equals ¥195). Prices for other rigs: Mosley TA-33—$307; Yaesu FT-101—$903; Collins KWM-2A—$4666; Hy-Gain TH6DXX—$508; Trio TS-820S—$1180.

Q. Can an American operate in Japan?

A. Yes, he can, but as a member of a club station only.

Q. Can you tell me the structure of a callsign for a Japanese club station?

A. Three-letter suffix, of which the first letter is Y or Z, such as JA1YAA, JH2ZAB.

Q. Is KA in Japan a ham station?

A. No. The Japanese government does not recognize KA as a ham. JA is forbidden to QSO with KA.

Q. What are the most wanted three states of USA from JA?

A. Delaware, Wyoming, and North Dakota.

Q. In which direction does W's sig come up to JA on short path?

A. Around 40° NE.

If you are planning a trip to Japan and would like to operate under their "club" system, contact the TIARA (club?) at: TIARA, Tomigaya Grand-301, 19-5 Tomigaya 2-chome, Sibuya, Tokyo 151, Japan, or telephone in Tokyo 485-1971.—N9YL.

OSCAR DXPEDITION ANNOUNCEMENT

WB6GFJ will return to Tahiti later this summer to operate on OSCAR. The Post and Telecommunications Office in Papeete has just notified Ross that his callsign has been authorized and is awaiting his arrival in Tahiti. His callsign will be FO0FB. QSL via WB6GFJ or the AMSAT-OSCAR QSL Bureau. This year, Ross will have Modes A, B, and J (CW and SSB), but will concentrate on Mode A QSOs from Tahiti. Plans are to operate on all currently-operating satellites with Mode A capabilities. As plans firm up, we will publish exact dates, times, frequencies, and exact orbits to look for Ross on the air on OSCAR.

Part of his time will be spent helping FO8 stations get started and operating on OSCAR. Anyone with unused 2 meter converters or small CW transmitters that could be left with FO8 stations for them to use on OSCAR would be appreciated. Also, anybody that can translate OSCAR information from English into French would be most appreciated—contact Ross as soon as possible.

Presently, the plans are to be in Tahiti sometime in August or September of this year.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 4

committees suppose. When someone like me can double the attendance, that's important to know.

All during the St. Louis hamfest, people introduced themselves to me and said they had driven hours to get there and hear what I had to say. It works. Committees should look over the ham world for people who will have things to say which hams want to hear . . . and one way or another get these speakers in. All too many of the speakers are excruciatingly dull, so it isn't easy to find the hot ones.

The 2,000 chairs in the hall were almost fully occupied, with over 1,500 estimated in the audience as I talked about amateur radio past, present, and future. That's not bad for a first hamfest in St. Louis, I'd say. I didn't see any League officials at the hamfest at all . . . and the League didn't even bother to have a booth!

The hamfest committee is to be congratulated on putting on a first-rate show, having an in-

Hams drove in from over 200 miles around to enjoy this day in St. Louis—ARCH MARCH—ARCH for the famous St. Louis arch and MARCH for Midwest Amateur Radio Computer Hobbyists. This is the 73 Magazine *booth (also* Kilobaud MICROCOMPUTING*) and Sherry handling subscriptions.*

In case any ARRLers who said that no hamfest could succeed without the support of the League have any lingering doubts, here is a picture of one part of the exhibits . . . and the whole place was packed like this. The ARRL, though invited, did not even bother to run a booth at the show and the local director refused to come. No one here was interested in politics, neither pro-ARRL nor con; it was a hamfest and a joyous one. It is a pity that the ARRL has to see every amateur function as a political threat.

teresting program (other than me), getting an exhibition hall full of exhibitors, and in doing all this in just a few weeks. The ARRL said there was no way to put on a good hamfest without starting a year ahead. Balderdash.

DALLAS AND ATLANTA

So far, my commitments for talking at hamfests for the rest of this year include a barrage at Dallas in early June and at Atlanta in mid-June. I'll be giving two talks at both hamfests . . . one on amateur radio and what can be done to get it going again, and the other on how to take advantage of the incredible opportunities for making money with microcomputers. I personally intend to increase my own net worth substantially during the next year or so, and thousands of others can get on the bandwagon . . . once they know the secret of how to go about it.

In September, I'll be giving a talk at the Hartford ARRL Convention. I'll bet they'll hate that! Right in their home town!

NOTHING CAN GO WRONG . . . GO WRONG . . . GO WRONG . . .

Joke number 1254C, wherein the captain of the plane gets on the intercom and says, "This is flight 73X, now leaving Boston and flying nonstop to Seattle. This is the first fully-automated transcontinental flight run entirely by microcomputer. The system has been thoroughly tested and it is so dependable that it is no longer necessary for a flight crew to featherbed on these flights. Be assured that every contingency has been considered and nothing whatever can possibly go wrong . . . go wrong . . . go wrong . . . go wrong . . ."

Which brings us to the ridiculous situation we've had with trying to keep up with subscriptions. If you get many magazines, you realize that we are not alone in trying to cope with the monumental screwups which computers can aggravate. Yes, I know all about computers not making mistakes, but I also know that programmers, computer salesmen, computer manufacturers, and data-input people are capable of incredible botching and/or deceptions.

Bill Blair, of the *Country Journal*, recently devoted a full-page editorial to apologizing for subscription aggravations to readers, citing Fawcett Publications as the cause of their miseries. Our problems stemmed from Data Input Service Corp. (DISC), down near Boston . . . with a big assist from Prime Computer, Inc.

A few years ago, we handled all of the subscriptions for *73* by cutting a small mimeograph-type of stencil for each subscriber. This paper stencil was then filed in a rack by zip code and it took maybe a day or two to handle a subscription, complete with sending any desired back issues. When there was any problem, all we had to do was go to the file, pull out the stencil, and see what had gone wrong. It took maybe a couple of minutes. One girl was able to handle everything.

Obviously, such an archaic system had to be improved. We called IBM and signed on the dotted line for what they recommended. It was an IBM 403 with keypunch and card sorter. It was so big and heavy that we had to have a special support in the basement to keep the floor from caving in.

The 403 was no blessing. It took as long to punch a card for each subscriber as it had to cut a stencil . . . and longer to file the cards, which still had to be hand-filed. The 403 printer was not as fast at making labels as the Elliott paper stencil printer. Such was progress.

After evaluating the net result of the new system, which cost about twice as much as the old one to use . . . and was slower, I started looking for an outside computer service to handle subscriptions. I found one which was recommended highly by one of our advertisers (Waters Manufacturing . . . it was also a subsidiary of Waters, so perhaps their enthusiasm was not without bias), and moved our subscription list there. Within three months we were in deep trouble.

It took us several months to go back over past subscriber lists and find the well over 2,000 subscribers who had been dropped seemingly at random by the computer. This outfit, which eventually became DISC, mumbled about dirt in the tape-read heads, or something.

As the number of subscriptions and the number of problems escalated, with our response time on looking up answers for angry readers going from the one or two days when we were doing everything ourselves to two and three months with the computer service, I got antsy to get things back on home ground. That was when I started calling computer firms to see what I needed, and it was then I found that computer folk had a language all their own which I couldn't understand.

It was my attempt to cope with this language barrier which resulted in my starting *Byte*, if you remember that magazine. I eventually gave up trying to learn enough to outwit the computer salesmen and software houses and hired my own "expert" to sort out the claims and promises of the computer firms.

My expert checked out everything available and recommended the Prime 300 computer as being the best for our application. I talked with the Prime salesmen and was assured that their system would be able to handle the subscriptions for *73*, for *Kilobaud MICROCOMPUTING*, our accounting, Reader Service, prospective subscriber lists, industry lists, advertising lists and data, repeater lists, article lists, daily orders, inventory, and a few other chores . . . no problem.

By mortgaging everything right down to the paper clips, we were able to buy a Prime 300. Our expert hired two full-time programmers to write programs for handling our subscriptions. One year later, we were ready to give it a try. We were desperate to use it because things had been going from bad to worse with the outside service.

Once we had the subscriptions on our own system, the problems went from worse to total disaster. One 13-megabyte disk was not enough, said Prime, no matter what their salesmen had said. So, we bought a second drive. In no time at all, that one had bogged and clogged, and a third drive was needed immediately. I think they ran about $15,000 each, heading us for the poorhouse. When things still grunted to a halt, the diagnosis was a need for 64K additional internal memory . . . another $15,000.

The subscriptions kept the computer from being usable for anything else at all. Reader Service had to go back to being done by hand, the accounting had to be sent out to a service agency, the payroll was sent to another agency, and so it went. I finally made enough of a fuss that Prime sent a technician to see what was wrong. It was then that they discovered that the Prime operating system had no provision for reusing disk space which had been left free by expired or moved subscribers. We were heading toward a need for hundreds of megabytes at this clip. Prime eventually came up with a mod for the operating system which allowed material to be deleted from a disk rather than just be ignored.

Added to the system programming problems were troubles with keeping the equipment running. The disks were going down every few days, we had memory problems, the power supply went out every now and then, and so it went. We finally gave up trying to cope with it and went back to DISC with the subscriptions.

Today, three years into owning the Prime 300, we are able to use it for handling the daily orders, Reader Service, and a few shorter lists . . . and that's about all. Beyond that, it bogs down and little comes out. I'd estimate that the system is able to do about 20% of what the Prime people promised—tops. I've been trying to get help from Prime on this, but they are so busy building new plants and selling larger systems that they seem unable to remember their sale of three years ago.

I am no fan of IBM . . . indeed, when I had IBM come in to recommend a new computer system for us, they suggested a System 32, with floppy disks and no application programming available. I think *that* probably would have been even worse than the Prime. But there is much to be said for buying a more-popular computer system and keeping away from smaller outfits such as Prime. It is almost impossible to find programmers or data-processing people with experience on the Prime. This means you have to hire people with little or no training and send them to Prime school at your own expense. Then you have to put them to work for a year or so on a system for which you are paying (they are not cheap) and give them time to get experienced.

The computer has been much more dependable since we fired all of the data-processing people who smoked. They swore up and down that the filters on the system would keep the smoke from hurting the disks, but disk failure now is rare with no smokers around.

For a while it appeared that DISC was going to be able to cope with the subscriptions, but eventually the problems got worse and worse. Three-year subscribers were entered for one year, address changes brought duplicate, triplicate, or no copies. Requests for help went unanswered. It was a disaster. As the complaints grew, I got more and more frustrated. My circulation people daily assured me that everything was being taken care of. All letters were being answered. All missing issues were being sent. Then I found that one of our customer-service people had merely been putting problems into a box and working on the top ones. There were about three-thousand unanswered complaints built up.

I raised hell. It took about twelve full-time people to work out the problems over a period of months, but it was like building a sand castle with the tide coming in. As fast as a thousand problems were solved, the data-input people at the service bureau would create two thousand more.

We shopped around for a long time, looking for a sub-

scription service (called fulfillment). We checked each one out with several of their customers because many magazines are having serious problems with this, as reported by Bill Blair. The magazine publishing magazine, *Folio*, often has grim stories of magazine fulfillment service problems, so they are a sad fact of modern publishing life.

All this is of little consolation to the innocent subscriber who gets caught in the middle of this mess. Since I subscribe to over 200 publications per month, I frequently run into these frustrations myself. I haven't found any magazines yet which are out to screw anyone . . . the screwing is there, but not intentional. I have found the circulation departments of most magazines to be as dedicated to helping the subscriber as ours, and just as frustrated as the subscribers over the problems.

Those readers of *73* who have not been loused up by our copelessness are asked to check around to see if they have any friends who have been victimized. Tell them that we really think we have things in hand at last. Our new agency, FAI, in New York, seems to be getting good marks from the other magazines they handle and have been getting our problems squared away quite satisfactorily for the last two months.

If you have written about a subscription problem and have not heard from us yet, you will receive a customer service report form in the next two to three weeks . . . this will speed up the handling of all problems and questions. Everyone here wants to have every subscriber happy and fulfilled. Please pass the word around at your club and over the air and let's make sure that everyone is made happy.

DEALING WITH THE FCC

The recent screwing of the hams by the FCC came as no surprise to those who are familiar with the way this government agency works. The real responsibility for the utter failure of the amateur community to come out of the situation with reasonable rules has to lie with both the ARRL and the ham industry.

The League, by convincing most amateurs that amateur radio is well represented by the ARRL, has discouraged any initiative by either individuals or clubs. Indeed, the ARRL has done all it can to discourage any individual approach to the FCC by amateurs and clubs. The net result of this is that when the ARRL fails to provide representation, there is none by anyone, so the FCC goes right ahead without any guidance and terrible things go wrong.

The FCC has been dealt with once in the last few years with great success. I hate to make a big deal out of this, but the results of this effort were so outstanding that it should not be swept under the table. I don't recall ever seeing even the slightest mention in *QST* of the ham/FCC meeting which brought about the complete turn of events with the FCC and the remarkable changes in repeater regulations, deregulation of amateurs, and a great many other changes.

Here's what happened. Amateurs in general were happy with the lack of restrictions on the use of repeaters and had adapted to the problems this lack of restrictions had caused by getting together and working out unofficial rules. We set up coordinating groups, repeater councils, got a national coordination plan working, etc., all without any help from either the FCC or the ARRL.

A few amateurs insisted that we *must* have FCC regulations for repeaters. Years later, the FCC suddenly acted by announcing brutally-restrictive rules and forcing the generation of incredible amounts of paperwork . . . to no one's benefit. The ARRL refused to do anything about the situation, partly because they had very little contact with repeaters and partly because they didn't want to anger anyone at the FCC.

Amateurs responded to the new rules by filing hundreds of petitions for reconsideration of the rules. Prose Walker, the chap in charge at the time, responded by throwing the whole lot in his wastebasket. I could see that we were going to get nowhere this way, so I decided it was time to do something about it.

Having been strongly instrumental in the nationalization of repeater frequency pairs via my *Repeater Bulletin* (monthly newsletter to repeater groups) and FM symposiums around the country which *73* sponsored, I contacted repeater groups and got them to send representatives to Washington to testify before the FCC. I set up the hearing and got the seven FCC Commissioners and the repeater group representatives into a hearing room and orchestrated a convincing discussion of the need for deregulating amateur radio. The ARRL, by the way, was asked to help with this and flatly refused. Right after the hearing, the League counsel took some of the visitors out to lunch and explained patronizingly that this sort of approach would not work . . . a waste of time.

It did work. The FCC Commissioners listened and were impressed. Wiley became chairman of the FCC and implemented the deregulation of amateur radio which we requested. The hearing was in January, 1974, and soon after that the restrictive repeater regulations began to be changed. Prose was "retired" and amateur rules improved enormously.

So what went wrong recently?

When the amateur industry gathered to testify before the Commissioners regarding ten meter linears, there was none of the cooperation which I had been able to bring to the 1974 hearing. I had gotten my group together the day before the hearing and we had gone through just what we wanted to get across, how best to do it, who should discuss what and answer questions on it, etc. We had our act together.

This time there was no act at all. ARMA, the manufacturer's association, got people from industry in to testify, but the ARRL's council was there and refused to cooperate with ARMA. Several of the manufacturers refused to cooperate with ARMA. The result was that the ARRL testimony, which went on interminably, took the wind out of the sails of the ARMA representative. The whole presentation was fumbling and lacked direction. Worse, no one had any concrete suggestions for anything to replace the FCC plan. The FCC didn't want to know what was wrong with their plan, they just wanted to do something. Without any alternative to offer, hams lost the battle completely.

I sat in on the discussions before the testimony and tried my best to get the manufacturers to provide a clear and coherent approach to the situation, complete with an easy out for the Commission. I got nowhere with this. I have tapes of these meetings and the FCC testimony if any historian wishes to review the sorry event at some later date.

After the fumbling and often emotional testimony by the ARRL and the industry, offering little constructive to the FCC, in came the EIA (Electronic Industries Association) representative. He had his act together. He got up, spoke for about five minutes, telling the FCC they were right, just exactly what they wanted to hear, and sat down. He won the day hands down. The score: CB—1, hams —0.

Sad to say, I see not even the slightest hint that either the ARRL or the ham industry has learned anything from this incredible debacle. ARMA is talking about paying a professional lobbyist in Washington, someone who not only is not a ham, but who also doesn't even know anything about amateur radio! I agree that we desperately need some strong representation in Washington—that's where the action is. But I disagree on grasping at straws. We need an experienced ham, possibly retired, who can spend the time to keep the FCC acquainted with what amateurs need in the way of changed rules. He could also keep in contact with key congressmen and senators to help put pressure where it is needed, when it is needed.

We also need to get our act together and organize hearings before the FCC when we need them. These hearings should be carefully planned and run. The Commissioners have a lot bigger pots to stir than amateur radio, so the more of their work we can do for them, the more cooperation we will get. We should try to remember that.

You can bet that if anything does get going in the way of an International Amateur Radio Lobby, a great deal of the push will be in Washington, where the power is. There is no reason why amateur radio should permit itself to be pushed around. We can't depend on the ARRL for these things, as we have seen all too clearly. If the League ever does decide to do something affirmative, then we can support them . . . but why support a vacuum?

SEEK FAME AND FORTUNE

Well, fame anyway. Getting published in *73* does often seem to pay off in wondrous ways. I'm talking about a lot more than just the recognition you get at the club or in contacts over the air—which can be heady enough. Many authors have written to tell me about doors that an article has opened for them . . . interesting jobs, consulting, etc.

Getting published still has the effect of making you an "expert" on a subject. It then follows that some firm somewhere has a need for such an expert and you find yourself in demand.

In addition to reflecting in the prominence a published article brings, there is the satisfaction of knowing that you've provided both education and entertainment to tens of thousands of people. How many times in your life can you reach out and touch that many people?

If all that doesn't move you to a typewriter, then let's get crass about it and point out that *73* pays hard cash for articles, and a lot more than any other ham magazine. Heck, one magazine seems to pay only if you get a lawyer to sue them for the pittance they promise. *QST* not only doesn't pay one cent for the articles they publish, but also you don't even get word on when your article will appear or any chance to even see it before publication! No wonder they

have so little of any significance.

With *73*, you get paid upon acceptance, not upon publication. This means you get paid right up front. Then, when your article is set in type and set up for publication, you will get a page proof of it to check over for any errors. You get to see it about the way it is going to appear in the magazine. And when it comes out, your call will be right there on the cover of the magazine.

One other thing . . . *QST* has a practice of rewriting just about every article. This means that your golden prose will be put through the meat grinder by some hack and the resultant mush will be attributed 100% to you, even though you haven't been given a chance to defend yourself. There are an awful lot of furious ex-*QST* authors. Have you noticed how few regular contributors there are in *QST* other than their poorly-paid staff? How many paid-staff articles do you find we have to use to pad out *73* to a reasonable size? And we publish about three times as many pages of articles as *QST* per month.

Another magazine strategem you want to watch out for is the small down payment, with the rest upon publication. This is a gem. It saves the magazine a bundle, obviously. It unfairly ties up the author, but without anything significant in pay. I understand that both *Byte* and *Interface Age* use this author-screwing system. And suppose they decide not to ever publish the article at all? You're helpless. So, for a few bucks, a magazine can keep articles which they have no intention of ever using from being submitted to competitor magazines.

It does take a substantial investment in articles to keep up a magazine inventory. For instance, at around $50 a page for *73*, this means that the hundred pages of articles in an issue will tie up about $5,000. We carry an inventory of perhaps six months in articles normally . . . about $30,000 or so.

What kind of articles are needed? Of course, the most-read articles are generally those about small construction projects. We're open for anything at all . . . antennas, gadgets, complete receivers, transceivers, test equipment, shack accessories, repeaters, microcomputers with a ham accent, autocall systems, anything on DXing, DXpeditions, humor which will make *me* laugh, good cartoons (no amateurs at this, please . . . except radio amateurs), club activities, club projects, stories of transmitter hunts, interviews with famous hams, reviews of new equipment . . . it is endless.

How many antenna articles can we publish? Hundreds . . . anything new and interesting will get a thousand hams heading for their roofs. Perhaps you've hooked a computer up for some CW processing. Antenna aiming? Digital circuits of almost any kind are read with great interest by most readers. I look through the ads and wish we could get good interesting articles on every piece of new equipment I see. Sure, I wish I could be the one to use the gear and write it up myself, but I'm already spread much too thin, so as a practical matter, I'd like to see reader evaluations. Why not help pay for your equipment that way?

Before you get a lot of ideas about conning manufacturers for free gear to be written up . . . no way. I flatly refuse to give anyone any prior agreement to publish anything. I want people who have spent their hard-earned money to cash in on this, not some sharpy on the con. Manufacturers, please go with me on this: Unless you hear from me personally about someone going to test something, do not get suckered into someone saying they are going to write an article on the equipment and therefore should get it free or for a discount. If I hear about it, no deal.

RTTY . . . I want a lot more material on RTTY. I want it on OSCAR and equipment for using OSCAR. I want updates on new stuff for SSTV. Let's keep it going. How about more info on TV satellite reception? How about weather satellite information? There are so many things going on that I don't understand the chap who calls up and says he would like to write an article but doesn't know what to write about.

FEBRUARY WINNER

For the second time in four months (he was also our November winner), Dr. Ralph E. Taggart WB8DQT has walked away with our $100 "Most Popular Article" check. Our readers used their Reader Service card ballots to select "Attention, Satellite Watchers!" as their favorite article in the February issue.

FCC

Reprinted from the Federal Register.

Amendment of Rules Concerning the Amateur Radio Service to Permit the Acceptance by Any Commission Office of Code Credit Certificates

AGENCY: Federal Communications Commission.

ACTION: Order (rule amendment).

SUMMARY: The Commission amends § 97.25 of its rules regulating the amateur radio service to permit the acceptance by any Commission office of Code Credit Certificates. Certificates are issued to applicants for amateur radio operator licenses who have completed the telegraphy elements of their examinations but fail the written elements. This action is taken to lessen the burden on those applicants who wish to complete the examination at an office other than the one at which the telegraphy portion was taken.

EFFECTIVE DATE: April 20, 1979.

ADDRESS: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: Mr. J. B. Johnston, Private Radio Bureau, (202) 254–6884.

SUPPLEMENTARY INFORMATION:

In the matter of amendment of §§ 97.3 and 97.25(b) of the Commission's Rules; Order.

Adopted: February 22, 1979.

Released: April 6, 1979.

By the Commission.

1. By an Order released on June 7, 1978, effective June 16, 1978, the Commission amended §§ 0.314, 1.922 and 97.25 of its Rules to provide for the issuance of Amateur Code Credit Certificates by the Engineer in Charge at each of its field offices. Certificates are issued to applicants for amateur radio operator licenses who successfully complete the telegraphy element of their examinations but fail the required written element. Section 97.25(b) currently provides that upon presentation of the Certificate to the Commission within one year of the date of its issuance, the applicant will be given credit for the telegraphy element at the speed listed. The purpose of the Certificate is to allow an applicant to receive his/her amateur license upon successful completion of the remaining examination element(s) without having to retake the telegraphy test.

2. Section 97.25(b) currently provides that an Amateur Code Credit Certificate will be honored only at the Commission office which issued it. This restriction was intended to allow Commission personnel to validate the authenticity of certificates presented for credit. However, it has also imposed a hardship on some applicants who wish to complete their examinations at an office other than the one at which they took their telegraphy test. Thus far, there has been no problem with attempts to falsify Certificates. Interim Amateur Permits and Temporary Radio Operator Authorizations may also be presented to gain examination credit toward higher classes of radio operator licenses. These documents are accepted at any Commission office and their authentication at offices other than the issuing one has not been difficult. As it appears that the more restrictive acceptance of Code Credit Certificates is unwarranted, the Commission is herewith amending § 97.25(b) to delete this restriction. Further, in order to formalize and clarify the criteria utilized for the issuance of the Certificate, the Commission now amends § 97.3 to include a definition of "Amateur Code Credit Certificate," and § 97.25(b) to specify the conditions under which such Certificates are issued.

3. As these amendments serve to clarify Commission procedures and to eliminate an unnecessary restriction, the Commission, pursuant to Section 553(b) of the Administrative Procedure Act, finds that prior public notice and the receipt of comments are unnecessary. Additionally, in order to expeditiously eliminate any confusion and inconvenience now caused to those taking amateur radio operatpr examinations, the Commission, pursuant to § 553(b)(3) of the Administrative Procedure Act, finds that it is desirable that these amendments be made effective with less than 30 days notice.

4. Accordingly, IT IS ORDERED, effective April 20, 1979, that Part 97 of the Commission's Rules and Regulations IS AMENDED as shown below. The authority for this action is found in Sections 4(i) and 303 of the Communications Act of 1934, as amended. For further information on these Rule changes contact Mr. J. B. Johnston, Personal Radio Branch, FCC, 1919 M Street, NW, Washington, DC 20554, Tele: (202) 254–6884.

(Secs. 4, 303, 48 Stat., as amended, 1066, 1082; 47 U.S.C. 154, 303)

Federal Communications Commission.

William J. Tricarico,
Secretary.

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended as follows:

In § 97.3, a new paragraph (aa) is added as follows:

§ 97.3 Definitions.

* * * * *

(aa) *Amateur Code Credit Certificate.* A certificate issued to applicants for an amateur operator license evidencing successful completion of a telegraphy examination element.

In § 97.25 paragraph (b) is amended to read as follows:

§ 97.25 Examination credit.

* * * * *

(b) Amateur Code Credit Certificates (FCC Form 845) will be issued by the engineers in Charge of FCC offices to applicants for amateur operator licenses who successfully complete telegraphy examination elements 1(A), 1(B) or 1(C), but who fail the associated written examination element(s). Upon presentation of a properly completed Amateur Code Credit Certificate, the FCC shall give the applicant for an amateur radio operator license examination credit for the code speed listed on the Amateur Code Credit Certificate. An Amateur Code Credit Certificate is valid for a period of one year from the date of its issuance.

Ham Help

I have a basin with four ultrasonic transducers affixed to the underside. I would like to get in touch with someone who has a circuit diagram and instructions to build an ultrasonic cleaner with a basin such as mine. I would also like to know how to determine the resonant frequency of these transducers and whether they must all be driven in phase.

Paul Leduc VE2DFL
76 17th Avenue
Roxboro, Quebec
Canada H8Y 3A4

Social Events

from page 26

will be June 10, 1979. For information, contact Henry Wener WB2ALW, 53 Sherrard St., East Hills NY 11577, or phone (516)-829-5880 days or (516)-484-4323 nights.

CHELSEA MI
JUN 3

The Chelsea Swap 'n Shop will be held on Sunday, June 3, 1979, at the Chelsea Fairgrounds, Chelsea, Michigan. Gates will open for sellers at 5:00 am and for the public from 8:00 am until 3:00 pm. Admission is $1.50 in advance or $2.00 at the gate. Children under twelve and non-ham spouses are admitted free. Talk-in on 146.52 and 146.37/.97. Proceeds will benefit the Dexter High School Radio Club and the Chelsea Communications Club.

STEVENS POINT WI
JUN 3

The Central Wisconsin Radio Amateurs, Ltd., will hold its swapfest picnic on Sunday, June 3, 1979, starting at 10:00 am at Bukolt Park, Stevens Point, Wisconsin. There will be a picnic area, refreshments, equipment sales, and prizes. For information, write to Frank L. Guth W9BCC, Secretary-Treasurer, Central Wisconsin Radio Amateurs, Ltd., 1632 Ellis Street, Stevens Point WI 54481.

WEST HUNTINGTON WV
JUN 3

The Tri-State ARA will hold its 17th annual hamfest and family picnic on June 3, 1979, starting at 10:00 am, at the Camden Amusement Park, West Huntington, West Virginia. There will be a planned program for the XYL and kids, or you can enjoy the amusement park if you prefer. There is a possibility the FCC will administer amateur exams. There will be major prizes, a large flea market, exhibitors, and displays. Dealers are always welcome to space in the covered pavilion. Talk-in on 34/94 or 16/76. For more information, write TARA, PO Box 1295, Huntington WV 25715.

MANASSAS VA
JUN 3

The Ole Virginia Hams Amateur Radio Club, Inc., will hold its annual hamfest on June 3, 1979, at the Prince William County Fairgrounds, located ½ mile south of Manassas, Virginia, on Rte. 234. Gates will open at 8:00 am but tailgaters may enter at 7:00 am. General admission is $3.00 per person, with children under 12 admitted free. Tailgating is $2.00 per vehicle, with over 300 spaces available. Prizes include a 5-band SSB transceiver, a synthesized 2 meter transceiver, and a Bird 43 wattmeter, plus many more. Breakfast and lunch are available on the premises. Featured will be an FM clinic, a YL program, a children's program, CW proficiency, and QSL bureau programs. Indoor exhibit space for dealers and manufacturers is available. For information, write to Sam Lebowich WB4HAV, OVHARC, PO Box 1255, Manassas VA 22110.

ALLENWOOD PA
JUN 3

The 8th annual Milton Amateur Radio Club Hamfest will be held on June 3, 1979, rain or shine, at the Allenwood Firemen's Fairgrounds, located on US Rte. 15, 4 miles north of Interstate 80, Allenwood, Pennsylvania. Hours are from 8:00 am to 5:00 pm. Registration for sellers is $2.50 advance or $3.00 at the gate. XYLs and children are free. Featured will be a flea market, an auction, a contest, cash door prizes, a free portable and mobile FM clinic, and supervised children's activities. There will be an indoor area available, plus food and beverages. Talk-in on .37/.97, .34/.94, and .52. For further details, call or write Kenneth Hering WA3IJU, RD #1, Box 381, Allenwood PA 17810, or phone (717)-538-9168.

PRINCETON IL
JUN 3

The Starved Rock Radio Club will hold its annual hamfest on Sunday, June 3, 1979, at the Bureau County Fairgrounds, Princeton, Illinois. The fairgrounds are centrally located and easily reached via routes 80-6-34-89-26. Watch for the large yellow "Hamfest" signs. There will be lots of room for the free swappers' area and park-

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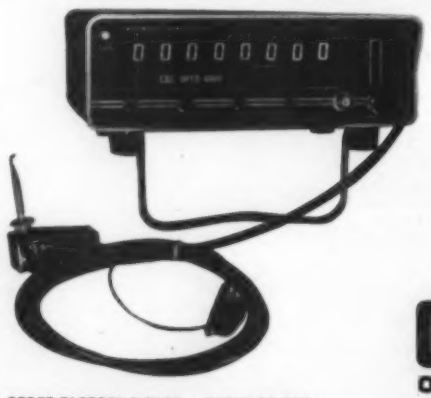

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GUELPH ONT CAN
JUN 9

The Central Ontario Amateur Radio Flea Market will be held on Saturday, June 9, 1979, from 8:00 am until 4:00 pm at Centennial Arena, College Ave. W., Guelph, Ontario, Canada. Commercial displays will open at 10:00 am. Admission is 75¢ per person with children 12 years and under admitted free. Admission for vendors is an additional $2.00. There will be a large indoor and outdoor flea market, commercial exhibits, free balloons, free handouts, and operating ham stations. Talk-in on .52/.52, .37/.97 VE3KSR, and .96/.36 VE3ZMG.

MEADVILLE PA
JUN 9

The Crawford Amateur Radio Society will hold its fifth annual hamfest on Saturday, June 9, 1979, at Crawford County Fairgrounds, Meadville, Pennsylvania. Admission is $2.00. Gates will open at 8:00 am. Bring your own tables. The cost to display is $2.00 for an inside area and $1.00 for an outside area. There will be door prizes, refreshments, and commercial displays. Talk-in on .04/.64, .81/.21, .63/.03. For details, write CARS, Hamfest Committee, PO Box 653, Meadville PA 16335.

BEMIDJI MN
JUN 9

A hamfest will be held on June 9-10, 1979, at Bemidji Fairgrounds, on the west side of town on Highway 2, Bemidji, Minnesota. There will be a complete program for hams, nonhams, and kids. Camping will be available on Saturday night. Tables are available at no charge. Tickets are $1.50. Talk-in on 146.34/.94 and 3935. For more information, write Jerry Pottratz WBØMSH, Rte. 2, Box 239B, Bemidji MN 56601.

SENATOBIA MS
JUN 9-10

The fourth annual Tri-State Hamfest will be held on June 9-10, 1979, in the coliseum of Northwest Junior College, Senatobia, Mississippi. Indoor air-conditioned space will be available for manufacturers, dealers, and distributors. For information, contact Joel P. Walker, 1979 Hamfest Chairman, PO Box 276, Hernando MS 38632; (601)-368-5277.

POMONA NJ
JUN 10

The Short Points Amateur Radio Club will hold its 2nd annual Atlantic City Area Hamfest and Electronic Fleamarket on Sunday, June 10, 1979, from 8:00 am to 4:00 pm, rain or shine, at Stockton State College Campus, Pomona, New Jersey. There will be free parking spaces, climate-controlled indoor sales area, clean restrooms, good food at realistic prices, paved and shaded tailgate area, free ac power at the indoor tables, and two chairs provided with each table rental. Featured will be door prizes, commercial exhibitors, free technical seminars, group meetings, and contests. Registration is $2.00 per person, with children under 12 free. Tailgating is $2.00 per car space, while the indoor sales area is $5.00 at the gate; bring your own table. The indoor sales area has an advance registration of only $5.00, which includes a table and two chairs. SPARC will give a free table and two chairs for each space rented to the first 80 persons to pre-register. Deadline for this special is June 1st. For information, write Monte Tremont WB2EYF, PO Box 142, Absecon NJ 08201, or phone (609)-266-2678.

MONROE MI
JUN 10

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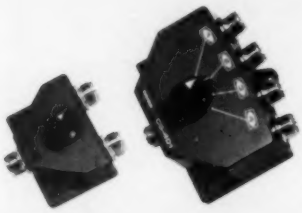

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✓ Reader Service—see page 195

will hold its annual hamfest Swap and Shop on June 10, 1979, from 8:00 am to 4:00 pm at the Monroe County Community College on Raisinville Rd. off M-50, Monroe, Michigan. Donation is $1.00 at the gate. There will be plenty of free parking, free trunk sales and indoor table space. Features will include a contest, an auction, commercial displays, and UHF, VHF, and HF technical sessions and demonstrations. Talk-in on 146.13/.73 or .52. For reservations and information, contact Fred Lux WD8ITZ, PO Box 982, Monroe MI 48161.

AKRON OH
JUN 10

The Goodyear Amateur Radio Club will hold its 12th annual hamfest picnic and flea market on Sunday, June 10, 1979, from 10:00 am to 5:00 pm at Goodyear Wingfoot Lake Park, near Rtes. 224 and 43, east of Akron, Ohio. There will be five main prizes, including a Yaesu FT-101ZD, a Midland 13-510, a Wilson Mark II, a Drake MN-4C, and a Bird wattmeter. Featured will be a large flea market, auction, and picnic area. Tickets are $3.00 each or two for $5.00. Talk-in on 146.04/.64. For more information, contact D. W. Rogers WA8SXJ, 161 South Hawkins Ave., Akron OH 44313.

OAK RIDGE TN
JUN 14-15

The Oak Ridge Amateur Radio Club will hold the Oak Ridge Amateur Radio Convention and Hamfest '79 on July 14-15, 1979, at the Oak Ridge Civic Center, Oak Ridge, Tennessee. Admission is $1.00. There will be commercial and flea market exhibitors. FCC exams will be given on Saturday at 8:00 am. Features for the ladies and kids include movies, a tour of the Museum of Science and Energy, or the pool, picnic, and playgrounds at the Civic Center. Camping facilities, motels, and restaurants are conveniently located. The week of July 9-16 will be proclaimed Amateur Radio Week in Oak Ridge by the Mayor. Talk-in on 146.88, 147.72, and 146.82. Local talk-in on 146.52. Anyone interested should contact Charles Byrge WB4OBE, PO Box 291, Oak Ridge TN 37830.

DUNELLEN NJ
JUN 16

The Raritan Valley Radio Club will hold its eighth annual hamfest on Saturday, June 16, 1979, from 8:00 am to 4:30 pm at Columbia Park, Dunellen, New Jersey. For details, write Raritan Valley Radio Club, RD 3, Box 317, Somerset NJ 08873, or phone WB2MNE at (201)-356-8435.

MIDLAND MI
JUN 16

The Central Michigan Amateur Repeater Association, Inc., will hold its fifth annual Midland Hamfest on Saturday, June 16, 1979, from 8:00 am until 3:00 pm at the Midland County Fairgrounds, Midland, Michigan. There will be door prizes with a drawing at 2:30 pm. Tickets are a $2.50 donation at the door, with XYL and junior op free on the OM's ticket. There will also be several computer displays. Tables will be available. An auction will be held at 1:00 pm for gear that isn't sold. Talk-in on .13/.73 and .52.

JACKSONVILLE IL
JUN 17

The Jacksonville Area Amateur Radio Club will hold its 14th annual hamfest and flea market on June 17, 1979, at the Morgan County Fairgrounds, Jacksonville, Illinois. Tickets are $1.50 each or 4 for $5.00. There will be indoor facilities, a camping area with a minimum fee, and food available on the grounds. Coffee and donuts will be served from 8:00-9:00 am. Talk-in on .52/.52.

TORRINGTON CT
JUN 17

The CQ Radio Club will hold its flea market and hamfest, rain or shine, on June 17, 1979, from 9:00 am to 5:00 pm at the Torrington Fish and Game Association grounds, located at Weed Rd., just off Rte. #4, between Torrington and Goshen, Connecticut. Admission is $1.00 per person including your vehicle. Children and ladies are free. Food and refreshments will be available at reasonable prices. There will also be prizes, plenty of parking, table space, and activities for the children.

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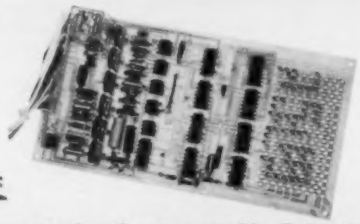

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CROWN POINT IN
JUN 17

The Lake County Amateur Radio Club will hold its 16th annual Dad's Day Hamfest on June 17, 1979, from 8:00 am until 5:00 pm at the Lake County Fairgrounds, Crown Point, Indiana. The event is all indoors. Donation is $1.50 in advance and $2.00 at the door. Table space is available on a first-come, first-served basis. There will be refreshments, a picnic area, ample parking, and a zoo and playground area for the children. Talk-in on 147.84/.24. For information and advanced tickets, write LCARC, PO Box 1909, Gary IN 46409.

BARNESVILLE PA
JUN 17

The Schuylkill Amateur Repeater Association will hold its 2nd annual hamfest on Sunday, June 17, 1979, at Lakewood Park, Barnesville, Pennsylvania, along Rte. 54, 3 miles east of Exit 37E on Interstate 81. Gates open at 9:00 am, rain or shine. Registration is $2.00, with XYL and children free and tailgaters $1.00 additional. Indoor tables are available at $2.00 per table. There will be large indoor and outdoor display areas, prizes, plenty of parking space, amusement rides, picnic tables, and refreshments. Talk-in on 147.78/.18 and 146.52. For more information, write SARA Hamfest, PO Box 901, Pottsville PA 17901.

LOUISVILLE KY
JUN 29-JUL 1

The Louisville Area Computer Club will hold its 4th annual Computerfest™ 1979 from June 29 through July 1, 1979, at the Bluegrass Convention Center, Louisville, Kentucky. Activities include a flea market, seminars, and exposition, as well as activities for the entire family. Seminar and exposition admission is $4.00. Pre-registered Ramada Inn guests ($29.00, single; $34.00, double) receive free admission. For advance mail information, write Computerfest '79, Louisville Area Computer Club, PO Box 70355, Louisville KY 40270, or phone Tom Eubank, Chairman, at (502)-895-1230.

BELLEFONTAINE OH
JUL 1

The Champaign Logan Amateur Radio Club, Inc., will hold its annual hamfest on Sunday, July 1, 1979, at the Logan County Fairgrounds, South Main Street and Lake Avenue, Bellefontaine, Ohio. There will be free admission and door prizes. Trunk and table sales are $1.00, and there will also be a bid table. Talk-in on 146.52. For more information, contact John L. Wentz W8HFK, Box 102, West Liberty OH 43357, or Frank Knull W8JS, 402 Lafayette Ave., Urbana OH 43078.

DUNKIRK NY
JUL 1

The Northwestern New York Repeater Association and the Northern Chautauqua Amateur Radio Club will hold their Lake Erie International Hamfest on Sunday, July 1, 1979, at the fairgrounds in Dunkirk, New York. A large flea market area and plenty of free parking will be provided. Tickets are $4.00 at the gate or $3.00 in advance. RV hookups are available. For information on advance sales or for a map showing easy directions from I-90, write to Dick Brinkerhoff WB2HEF, 123 5th St., Dunkirk NY 14048.

HARRISBURG PA
JUL 4

The Harrisburg RAC will hold its annual Firecracker Hamfest on Wednesday, July 4, 1979, at the Shellsville VFW picnic grounds, I-81 north, Exit #27 or #28, Racetrack Exit, Harrisburg, Pennsylvania. Look for the large balloon. Admission is $3.00, with no charge for tailgating. Tables will be available in the pavilion. Talk-in on .52/.52.

WELLINGTON OH
JUL 7

The Northern Ohio Amateur Radio Society will hold its second annual NOARSFEST on Saturday, July 7, 1979, at the Lorain County Fairgrounds, one mile west of Rte. 58 on Rte. 18, Wellington, Ohio. Admission tickets are $1.50 in advance and $2.00 at the gate and are good for all prize drawings. Children under 12 are admitted free. Gates open for the sellers and dealers at 6:00 am and to the public from 7:00 am to 5:00 pm. Indoor dealer tables are $4.00 each by advance registration. Drawing-only tickets are available by mail or at the gate for $1.00 each. Flea market spaces are $1.00 each. There will be over 100 prizes, including a DenTron HF-200 transceiver, a Ten-Tec 509, a DenTron GLA-1000, a Wilson Mark II, and an Optoelec-electronics counter. There will be plenty of food and free parking. Featured will be a large indoor exhibit hall for dealers and a huge blacktopped midway for flea market and trunk sales. There will be free camping outside the gates on Friday night, but no hookups. For advance registration, information, or tickets, write NOARSFEST, PO Box 354, Lorain OH 44052.

INDIANAPOLIS IN
JUL 8

The Indianapolis Amateur Radio Association will sponsor the Indianapolis Hamfest on Sunday, July 8, 1979, at the Marion County Fairgrounds, on the southeast corner of Indianapolis at the intersection of Interstates 74 and 465, Indianapolis, Indiana. There will be commercial exhibitors and dealer displays for a fee of $30.00 per booth. The commercial building will be open from 12:00 noon until 9:00 pm on Saturday and will reopen at 7:00 am on Sunday. Camper hookup facilities are available on the fairgrounds for overnight parking if you arrive on Saturday. A food and drink vendor will have a setup outside, while a professional caterer will have facilities inside. For more information, write to the Indianapolis Hamfest, PO Box 1002, Indianapolis IN 46206.

OAK CREEK WI
JUL 14

The South Milwaukee Amateur Radio Club will hold its annual Swapfest '79 on Saturday, July 14, 1979, at American Legion Post #434, 9327 S. Shepard Avenue, Oak Creek, Wisconsin. Admission is $2.00 and includes a happy hour with free beverages. Prizes include a $100 first prize, a $50 second prize, and a variety of other prizes. Activities will begin at 7:00 am and continue until 5:00 pm. Parking, a picnic area, hot and cold sandwiches, and liquid refreshments will be available on the grounds. Overnight

camping is also available. Talk-in on 146.94. More details, including a map, may be obtained from the South Milwaukee Amateur Radio Club, Inc., Robert Kastelic WB9TIK, Secretary, PO Box 102, South Milwaukee WI 53172.

TERRE HAUTE IN
JUL 15

The 33rd annual WVARA Hamfest will be held on July 15, 1979, at the Vigo County Fairgrounds, one mile south of I-70 on US 41, Terre Haute, Indiana. Overnight camping will be available. There will be a free flea market, a covered flea market at $2.00 for a 12' x 12' space with some tables and ac available, XYL bingo, food, refreshments, and valuable prizes. Advance ticket sales are $1.50 or 4 for $5.00. Tickets at the gate are $2.00 or 3 for $5.00, with children under 12 free. Talk-in on .25/.85 and .52. For tickets and information, send an SASE to WVARA Hamfest, PO Box 81, Terre Haute IN 47808.

ALLENTOWN PA
JUL 15

The Delaware-Lehigh ARC, Inc., the BGYE, Inc., and the Lehigh Valley ARC, Inc., will hold their Tri-Club Hamfest on July 15, 1979, from 8:00 am to 4:00 pm at the Allentown Police Academy pistol range on Lehigh Parkway South at Allentown, Pennsylvania. Admission is $2.00 for lookers and $4.00 for sellers. Talk-in on .34/.94 and .52.

WILKES-BARRE PA
JUL 15

The Broadcasters Amateur Radio Club will hold its 2nd annual hamfest on July 15, 1979, from 9:00 am to 4:00 pm at Pocono Downs Racetrack, Rte. 315, four miles north of Wilkes-Barre, Pennsylvania. Setup begins at 8:00 am. Admission is $2.50, with no additional fee for sellers. XYLs and children are free. The event is all indoors. Talk-in on 147.66/.06 or 146.52. For more information, write John Soha W3KU, 62 S. Franklin Street, Wilkes-Barre PA 18707, or phone (717)-823-3101.

CANTON OH
JUL 15

The fifth annual Hall of Fame Hamfest will be held on Sunday, July 15, 1979, at Stark County Fairgrounds, Canton, Ohio. Tickets are $2.50 in advance and $3.00 at the gate. Mobile check-in on .19/.79 or .52/.52. For information, contact Max Lebold WA8SHP, 10877 Hazelview Ave., Alliance OH 44601.

GUANAJUATO MEX
JUL 19-21

The first annual ARARMLMRE will be held in Guanajuato, Mexico, from July 19-21, 1979. Guanajuato is located 230 miles north of Mexico City. Registration will be US $13.00. A package will be available for US $40.00 and will include 2 banquets, 1 dinner dance, sight-seeing, theater, and gifts. Drawings will be held, with a grand prize being an SSTV setup. A total of 500 prizes will be given away. The US $40.00 includes registration. Hotels are available with prices ranging from US $10.00 and up for a double room. English-speaking guides are available from the University of Guanajuato. Talk-in on 147.63/.03, 146.10/.70, and 149.22/.82. HF/SSB frequencies will also be operating, and we hope to arrange special licenses for visiting hams who may wish to operate from XE1-land during their stay. There will be a flea market and demonstrations at the convention hall. For more information, contact the Radio Club Leon, PO Box 12A, Leon, Guanajuato, Mexico.

EUGENE OR
JUL 21-22

The 4th annual Lane County Ham Fair will be held on July 21-22, 1979, at the Oregon National Guard Armory, 2515 Centennial Blvd., Eugene, Oregon. Registration is $3.00, and an extra drawing ticket is given with advance registration. There will be displays, lectures, contests, swapshop, transmitter hunt, and entertainment. The facilities provide plenty of free parking for motor homes and trailers.

For information and advance reservations, phone or write Wanda or Earl Hemenway, 2366 Madison, Eugene OR 97405 at (503)-485-5575.

ESSEX MT
JUL 21-22

The International Glacier-Waterton Hamfest will be held on July 21-22, 1979, at the Three Forks Campground, ten miles east of Essex, Montana, on US Highway 2. Registration is at 9:00 am. Talk-in on .52 and .34/.94. For more information, write Glacier-Waterton Hamfest, PO Box 2225, Missoula MT 59806.

PITTSFIELD MA
JUL 21-22

The NoBARC Hamfest will be held on July 21-22, 1979, at Cummington Fairgrounds, Pittsfield, Massachusetts. There will be tech talks, demonstrations, and dealers. Flea market admission is $1.00. Advance registration is $3.00 single and $5.00 with spouse, and $4.00/$6.00 at the gate. Gates open at 5:00 pm on Friday for free camping. Talk-in on 146.31/.91. For reservations, contact Tom Hamilton WA1VPX, 206 California Ave., Pittsfield MA 01201.

GOLDEN CO
JUL 22

The Rocky Mountain Radio League, Inc., will hold its Field Demonstration Day and Swapfest on July 22, 1979, at the home of Karl Ramstetter WA0HJZ, which is located on Highway 93, Golden Gate Canyon Road. This is accessible by going one mile north of the city limits of Golden, turning westward off Highway 93 onto Golden Gate Canyon Road, proceeding for approximately 7½ miles, and making a right turn across the cattle guards. Signs will be posted for further directions. There will be demonstrations, including slow-scan TV and computers, door prizes, and a potluck lunch, with soft drinks and ice supplied by the League. It would be appreciated if everyone would make his contribution to the potluck lunch by bringing his favorite dish and helping out the League with any spare blankets and chairs. There will be camping facilities available for campers, trailers, mobile homes, etc., on Saturday afternoon before the Fest. No dogs, guns, or motorbikes, please.

MARSHALL MO
JUL 22

The Indian Foothills Amateur Radio Club will hold its 4th annual hamfest on July 22, 1979, at the Saline County Fairgrounds, Marshall, Missouri. Tickets are $2.00 each or 3 for $5.00 in advance; $2.50 at the door. Registration is at 8:00 am, with lunch at 11:30 pm (all you can eat) and the drawing at 2:30 pm. Prizes include a Tempo S1, a Dentron Jr. Monitor™ tuner, and many more. There will be flea markets for the OM and XYL. There is no charge for flea market tables this year, but reservations are requested. There will also be old and new equipment displays, a 10-X booth, and other activities for the XYLs. Talk-in on .52, .28/.88, and 147.84/.24. For information and tickets, write Norman Gibbins WB0SZI, 692 North Ted, Marshall MO 65340.

MACKS INN ID
JUL 27-29

WIMU (Wyoming, Idaho, Montana, and Utah) will hold its 47th annual hamfest on July 27-29, 1979, at Macks Inn, Idaho. Festivities include 2-meter hunts, OSCAR demonstrations, ladies' crafts, and a repeater display. The pre-registration prize will be a Wilson Mark II handie-talkie complete with touchtone™, battery pack, and charger. The grand prize is your choice of an Icom IC-211 or a Kenwood TS-520. Saturday night special events include kids' movies and an adult dance. For further information, contact Dave Hunting WB7FGV, Box 662, Kemmerer WY 83101, or call (307)-877-9440.

OKLAHOMA CITY OK
JUL 27-29

The Central Oklahoma Radio Amateurs will sponsor the Oklahoma State ARRL Convention and "Ham Holiday" on July 27-29, 1979, at Lincoln Plaza, 4445 Lincoln Blvd., Oklahoma City, Oklahoma. The program will include an ARRL forum and technical talks on 1-GHz techniques, fast-scan TV for radio amateurs, NBVM, and other subjects of current interest. In addition, a full program is scheduled for the ladies. Pre-registration will be $4.00 if received before July 20. After that date, it will be $5.00. A synthesized 800-channel VHF transceiver will be awarded to encourage pre-registration. The main award will be a TS-120V with power supply. Adequate rooms are available for commercial exhibitors and swappers. Mail your registration to CORA, PO Box 14424, Oklahoma City OK 73113.

Unlimited parking space is also available.

MOOSE JAW
SASKATCHEWAN CAN
JUL 27-29

The Moose Jaw Amateur Radio Club will hold its 1979 Hamfest (Particifest 79) on July 27-29, 1979, at the Saskatchewan Technical Institute, 600 Saskatchewan St. W., Moose Jaw, Saskatchewan, Canada. Registration will be held on Friday evening with a full day of activities on Saturday culminating in a banquet and dance. Most of the meetings and workshops will be held on Sunday. There will also be a busy schedule for the XYLs.

OLIVER BC CAN
JUL 28-29

The Okanagan International Hamfest will be held on July 28-29, 1979, at Gallagher Lake KOA Kampsite, 8 miles north of Oliver, B.C., Canada. Registration starts at 9:00 am Saturday. Activities start at 1:00 pm Saturday and continue until 2:00 pm Sunday. Ladies may bring their hobbies and items for a white-elephant sale. Featured will be prizes, a flea market, bunny hunts, entertainment, a home-brew contest, and more. A potluck lunch will be served Sunday at noon. Call-in on 3800, .34/.94, and .76 simplex. For information, write

Continued on page 188

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A 4K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. The Super Monitor is written with subroutines allowing users to take advantage of monitor functions simply by calling them up.

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The **Power Supply Kit** for the Super Expansion Board is a 5 amp supply with multiple positive and negative voltages $29.95. Add $4.00 for shipping. Prepunched frame $5.00. Case $10.00. Add $1.50 for shipping.

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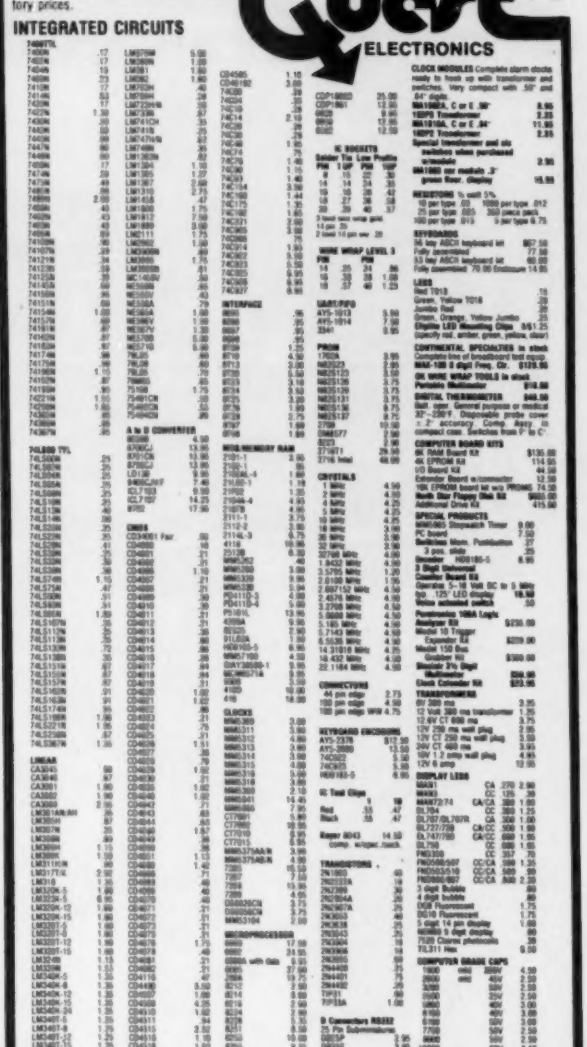

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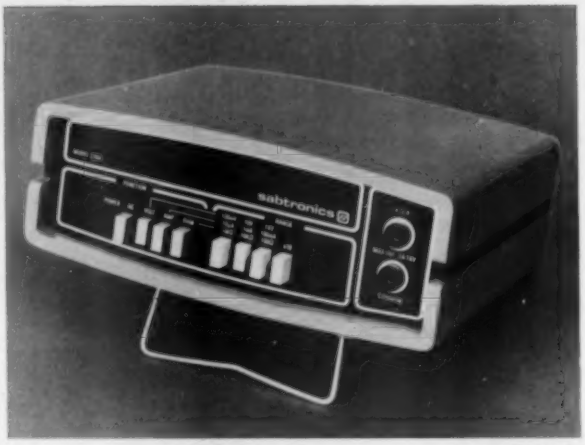

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3N128	1.35 or 10/10.00
2N5248	.60 or 10/ 4.50
MPF131	.60 or 10/ 5.00
2N4303	.45 or 10/ 3.50
2N3958	2.95 each
MFE2000	.90 or 10/ 8.00
MFE2001	.99 or 10/ 8.00
MFE2008	4.20 or 10/36.00
MFE2009	4.80 or 10/39.00
MFE3002	3.35 each
MMF-5	5.00 each
MFE120	1.00 or 10/ 8.50
2N3436	2.25 each
2N4416	1.00 each
MFE131	1.05 each

MICROWAVE DIODES

1N21D	$ 1.40
1N21C	1.05
1N21WE	2.00
1N23B	1.05
1N23C	1.05
1N23CR	2.00
1N23E	2.00
1N23F	4.10
1N23WE	2.10
1N25	3.03
1N121WE	4.00
1N286	5.00
1N416E	5.00
1N446	8.00
1N3655A	4.00
1N5153	15.00
1N5711	1.20

ADDITIONAL R.F. TRANSISTORS

40894	$ 2.50
MRF454/568BLYCF	17.10

LM566V VCO/FUNCTION GENERATOR

$.99 each

LM340T-5 & LM340T-12

75¢ each

SEMTECH MINISTIC

high voltage rectifiers SFMS
20K 20,000PIV
20ma $1.99 each

1500PIV 1.5 AMPS RECTIFIERS 10/$1.50

MC4024P & MC4044P $3.25 each

HEP 170 2.5 Amps

1000PIV 10/$2.00 or 100/$14.50

POTTER & BRUMFIELD 12VDC RELAYS

4PDT	3 Amps	$2.95
SPDT	25 Amps	$5.95
2PDT	3 Amps	$1.99
4PDT	25 Amps	$6.99

BRIDGES 24 AMPS 500PIV $2.99 each

4CX250B/R SOCKETS AND CHIMNEYS NEW

$14.95 per set (1 socket, 1 chimney)

B&W COILS

1206T	$3.99
2006T	$7.99

FAIRCHILD REGULATOR 78H05KC $6.99 each

TUBES

6146B	$6.50

MINIMUM ORDER $5.00

Minimum Shipping $1. Insurance 35¢ per $100. COD charges 85¢ to street address only! We prefer street address as we ship UPS and P.O. Box #'s take up to 50% longer to deliver. We accept VISA or Mastercharge. Please list complete card number and expiration date. Allow 10% extra for shipping of heavy items. *We reserve the right to change prices without notice.* All items listed are subject to prior sale. Some items listed are in small quantities.

Reader Service—see page 195

FREQUENCY COUNTER KIT

Outstanding Performance

Incredible Price $89.95

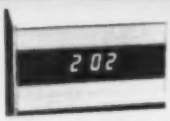
CT-50

The CT-50 is a versatile and precision frequency counter which will measure frequencies to 60 mHz and up to 600 mHz with the CT-600 option. Large Scale Integration, CMOS circuitry and solid state display technology have enabled this counter to match performance found in units selling for over three times as much. Low power consumption (typically 300-400 ma) makes the CT-50 ideal for portable battery operation. Features of the CT-50 include: large 8 digit LED display, RF shielded all metal case, easy pushbutton operation, automatic decimal point, fully socketed IC chips and input protection to 50 volts to insure against accidental burnout or overload. And, the best feature of all is the easy assembly. Clear, step by step instructions guide you to a finished unit you can rely on. **Order your today!**

SPECIFICATIONS:
Frequency range: 6 Hz to 65 mHz, 600 mHz with CT-600
Resolution: 10 Hz w/ 0.1 sec gate; 1 Hz w/ 1 sec gate
Readout: 8 digit, 0.4" high LED, direct readout in mHz
Accuracy: adjustable to 0.3 ppm
Stability: 2.0 ppm over 10° to 40° C temperature compensated
Input: BNC, 1 megohm, 20 pf direct, 50 ohm with CT-600
Overload: 50VAC maximum, all modes
Sensitivity: less than 25 mv to 65 mHz, 50-150 mv to 600 mHz
Power: 110 VAC, 5 Watts or 12 VDC @ 400 ma
Size: 6" x 4" x 2" high quality aluminum case, 2 lbs
ICs: 13 units, all socketed

CT-50, 60 mHz counter kit	$89.95
CT-50WT, 60 mHz counter, wired and tested	159.95
CT-600, 600 mHz scaler option, add	29.95
CB-1, Color TV calibrator-stabilizer	$14.95
DP-1, DC probe, general purpose probe	12.95
HP-1, High impedance probe, non-loading	15.95

CAR CLOCK



The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock, which is a snap to build and install. Clock movement is completely assembled—you only solder 3 wires and 2 switches, takes about 15 minutes! Display is bright green with automatic brightness control photocell—assures you of a highly readable display, day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify).

DC-3 kit, 12 hour format	$22.95
DC-3 wired and tested	$29.95
110V AC adapter	$5.95

Under dash car clock

12/24 hour clock in a beautiful plastic case features: 6 jumbo RED LEDS, high accuracy (1 min./mo.), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer automatically adjusts display to ambient light level.

DC-11 clock with mtg. bracket	$27.95
DM-1 dimmer adapter	2.50

PRESCALER

Extend the range of your counter to 600 mHz. Works with any counter. Includes 2 transistor pre-amp to give super sens., typically 20 mv at 150 mHz. Specify ÷ 10 or ÷ 100 ratio.

PS-1B, 600 mHz prescaler	$59.95
PS-1BK, 600 mHz prescaler kit	49.95

OP-AMP SPECIAL

741 mini dip	12/$2.00
B1-FET mini dip, 741 type	10/$2.00

VIDEO TERMINAL

A completely self-contained, stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Two units available, common features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 3216 is 32 char. by 16 lines, 2 pages with memory dump feature. The 6416 is 64 char. by 16 lines, with scrolling, upper and lower case (optional) and has RS-232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 3216, terminal card	$149.95
RE 6416, terminal card	189.95
Lower Case option, 6416 only	13.95
Power Supply Kit	14.95
Video/RF Modulator, VD-1	6.95
Assembled, tested units, add	60.00

CALENDAR ALARM CLOCK

The clock that's got it all. 6-.5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size: 5x4x2 inches.
Complete kit, less case (not available)

DC-9	$34.95

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 in for 15 out, 4 W in for 30 out. Max. output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit	$22.95
TR-1, RF sensed T-R relay kit	6.95

FM MINI MIKE KIT

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 kit	$12.95
FM-3 wired and tested	16.95

CLOCK KITS

our Best Seller your Best Deal

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, bronze, black, blue (specify).

Clock kit, 12/24 hour, DC-5	$22.95
Clock with 10 min. ID timer, 12/24 hour, DC-10	27.95
Alarm clock, 12 hour only, DC-8	24.95
12V DC car clock, DC-7	27.95

For wired and tested clocks add $10.00 to kit price.

Hard to find PARTS

LINEAR ICs		**REGULATORS**	
301	$ .35	78MG	$1.25
324	1.50	723	.50
380	1.25	309K	.85
380-8	.75	7805	.85
555	.45	78L05	.25
556	.85	7905	1.25
566	1.15	7812	.85
567	1.25	7912	1.25
1458	.50	7815	.85
2900	.50	**TTL ICs**	
CMOS ICs		74S00	.35
4011	.20	7447	.65
4013	.35	7475	.50
4046	1.65	7490	.50
4049	.40	74196TI	1.35
4518	1.25	**SPECIAL ICs**	
5369	1.75	11C90	13.50
TRANSISTORS		10116	1.25
2N3904 type	10/1.00	4511	2.00
2N3906 type	10/1.00	5314	2.95
RCA 30W Pwr	3/1.00	5375AB	2.95
RCA 30W Pwr	3/1.00	7001	6.50
2N3055	.60	8038	9.00
UJT 2N2646 type	3/2.00	7208	17.95
FET MPF102 type	3/2.00	**LEDs**	
UHF 2N5179 type	3/2.00	Jumbo red	8/1.00
MRF 238 RF	11.95	Jumbo green	6/1.00
SOCKETS		Jumbo yellow	6/1.00
8 pin	10/2.00	Mini red	8/1.00
14 pin	10/2.00	Micro red	8/1.00
16 pin	10/2.00	Bipolar	.75
24 pin	4/2.00	**FERRITE BEADS**	
28 pin	4/2.00	With info. specs	15/1.00
40 pin	3/2.00	6 hole balun	5/1.00

Ramsey's famous MINI-KITS

FM WIRELESS MIKE KIT

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.
FM-1 kit **$2.95** FM-2 kit **$4.95**

COLOR ORGAN/MUSIC LIGHTS

See music come alive! 3 different lights flicker with music. One light for lows, one for the mid-range and one for the highs. Each channel individually adjustable, and drives up to 300W. Great for parties, band music, nite clubs and more.
Complete kit, ML-1 **$7.95**

LED BLINKY KIT

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts.
Complete kit, BL-1 **$2.95**

VIDEO MODULATOR KIT

Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market!
Complete kit, VD-1 **$6.95**

TONE DECODER

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone decoding, tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 **$5.95**

WHISPER LIGHT KIT

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Completely self-contained, includes mike, runs on 110VAC, controls up to 300 watts.
Complete kit, WL-1 **$6.95**

SUPER SLEUTH

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.
Complete kit, BN-9 **$5.95**

POWER SUPPLY KIT

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and + 5V at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3V @ 1 A and 24 VCT.
Complete kit, PS-3LT **$6.95**

SIREN KIT

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.
Complete kit, SM-3 **$2.95**

ramsey electronics
BOX 4072, ROCHESTER, N.Y. 14610

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(716) 271-6487

TERMS: Satisfaction guaranteed or money refunded. COD: add $1.50. Minimum order $6.00. Orders under $10.00: add $.75. Add 5% for postage, insurance, handling. Overseas: add 15%. NY residents: add sales tax.

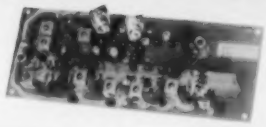
RB

hamtronics, inc.

H16 **OSCAR HEADQUARTERS**

★ **Quality VHF & UHF Kits At Affordable Prices**

SSB TRANSMITTING CONVERTERS



FEATURES:
- Linear Converter for SSB, CW, FM, etc.
- A fraction of the price of other units
- 2W p.e.p. output with 1 MW of drive
- Use low power tap on exciter or attenuator pad
- Easy to align with built-in test points

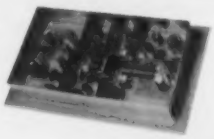
Frequency Schemes Available:

MODEL	INPUT(MHz)	OUTPUT(MHz)
XV2-1	28-30	50-52
XV2-2	28-30	220-222
XV2-3	28-30	222-224
XV2-4	28-30	144-146
XV2-5	28-29	145-146
XV2-6	26-28	144-146

ONLY $59.95!

VHF RECEIVING CONVERTERS

LET YOU RECEIVE OSCAR AND OTHER EXCITING SIGNALS ON YOUR PRESENT HF RECEIVER!



MODEL	RF RANGE	I-F RANGE
C28	28-32MHz	144-148MHz
C50	50-52	28-30
C144	144-146	28-30
C145	145-147	28-30
C146	146-148	28-30
C110	Aircraft	26-30
C220	220-222	28-30
C222	222-224	28-30
Special	Inquire About Other Ranges	

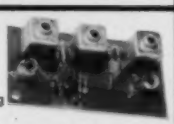
ONLY $34.95

FAMOUS HAMTRONICS PREAMPS

let you hear the weak ones!

Great for OSCAR, SSB, FM, ATV. Over 10,000 in use throughout the world on all types of receivers.

P9 Kit $12.95
P14 Wired $24.95
Specify Band When Ordering

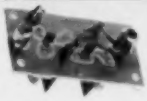


- Deluxe vhf model for applications where space permits • 1-1/2 x 3" • Models avail to cover any 4 MHz band in the 26-230 MHz range • 12 Vdc
- 2 stages • Ideal for OSCAR • 20 db gain
- Diode transient protection • Easily tunable

P8 Kit $10.95
P16 Wired $21.95
Specify Band

- Miniature vhf model for tight spaces – size only 1/2x2-3/8 • Models avail to cover any 4 MHz band in the range 20-230 MHz • 20 db gain • 12V

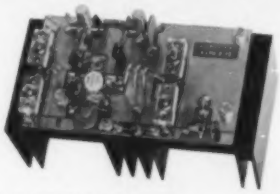
P15 Kit $18.95
P35 Wired $34.95



- Covers any 6 MHz band in UHF range of 380-520 MHz
- 20 dB gain • 2 stages • Low noise

VHF Linear PA's

- Use as Linear or Class C PA's • For XV-2 Xmtg Converters, T50 Exciters, or any 2W Exciter



LPA 2-15 Kit $59.95
- 15W out (linear) or 20W (class C) • Solid State T/R Switching • Models for 6M, 2M, or 220 MHz

LPA 2-45 Kit $109.95
- 45W out (linear) or 50W (class C)
- Models for 6M or 2M

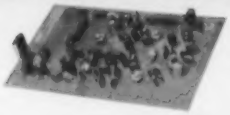
LPA 8-45 Kit $89.95
For 2M, 8-10W in, 45W out

T80 UHF POWER AMP

- Broadband PA • No Tuning Required • Class C PA
- 430-470 MHz
- 13-15W Out
- 200 mW Drive

Model T80-450
$79.95
Wired & Tested

UHF RECEIVING CONVERTERS



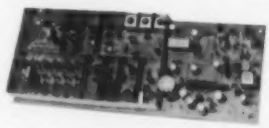
MODEL	RF RANGE	I-F RANGE
C432-2	432-434	28-30MHz
C432-4	432-436	144-146
C432-5	435-437	28-30
C432-7	427.25	61.25
C432-9	439.25	61.25
Special	Inquire About Other Ranges	

ONLY $34.95

A9 Extruded Alum Case with BNC's for above Converters (Optional) ... $12.95

VHF&UHF FM RECEIVERS

- NEW GENERATION RECEIVERS
- MORE SENSITIVE • MORE SELECTIVE (70 or 100 dB)
- COMMERCIAL GRADE DESIGN
- EASY TO ALIGN WITH BUILT-IN TEST CKTS
- LOWER OVERALL COST THAN EVER BEFORE



R70 6-channel VHF Receiver Kit for 2M, 6M, 10M, 220 MHz, or com'l bands..... $69.95
Optional xtal filter for 100 dB adj chan 10.00

R90 UHF Receiver Kit for any 2 MHz segment of 380-520 MHz band..... $89.95

NEW FM/CW EXCITER KITS

BUILD UP YOUR OWN GEAR FOR MODULAR STATIONS, REPEATERS, & CONTROL LINKS
- Rated for Continuous Duty • Professional Sounding Audio • Built-in Testing Aids

T50 Six Channel, 2W Exciter for 2M, 6M, or 220 MHz (Specify band)..... $49.95

T50U Six Channel, 1W Exciter for 430-450 MHz uhf operation $49.95

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IT'S EASY TO ORDER!
CALL OR WRITE **NOW** FOR **FREE** CATALOG OR TO PLACE ORDER!

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IN CANADA, order from Communications Plus, 3680 Cote Vertu; St-Laurent, Quebec or phone 514-337-7255. Add 38% to cover duty, tax, and exchange.

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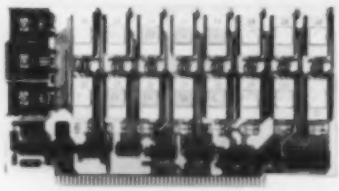
--Dealer Inquiries Invited--

16K EPROM CARD-S 100 BUSS



$59.95 KIT

OUR BEST SELLING KIT!

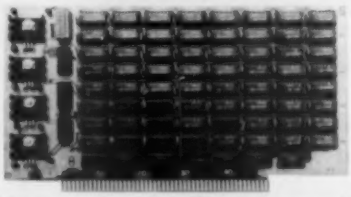
USES 2708's!

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. All parts (except 2708's) are included. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

OUR 450NS 2708'S ARE $8.95 EA. WITH PURCHASE OF KIT

ASSEMBLED AND FULLY TESTED ADD $25

8K LOW POWER RAM KIT-S 100 BUSS
250 NS SALE!



ADD $5 FOR 250NS!

$129 KIT

(450 NS RAMS!)

Thousands of computer systems rely on this rugged, work horse, RAM board. Designed for error-free, NO HASSLE, systems use.

KIT FEATURES:

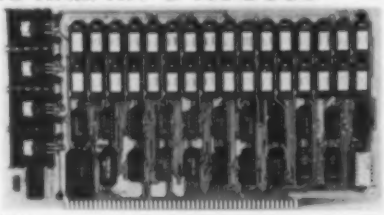
1. Doubled sided PC Board with solder mask and silk screen layout.Gold plated contact fingers.
2. All sockets included.
3. Fully buffered on all address and data lines.
4. Phantom is jumper selectable to pin 67.
5. FOUR 7805 regulators are provided on card.

Blank PC Board w/Documentation **$29.95**
Low Profile Socket Set...**13.50**
Support IC's (TTL & Regulators) **$9.75**
Bypass CAP's (Disc & Tantalums) **$4.50**

ASSEMBLED AND FULLY BURNED IN ADD $30

16K STATIC RAM KIT-S 100 BUSS

$295 KIT



FULLY STATIC, AT DYNAMIC PRICES

WHY THE 2114 RAM CHIP?

We feel the 2114 will be the next industry standard RAM chip (like the 2102 was). This means price, availability, and quality will all be good! Next, the 2114 is FULLY STATIC! We feel this is the **ONLY** way to go on the S-100 Buss! We've all heard the HORROR stories about some Dynamic Ram Boards having trouble with DMA and FLOPPY DISC DRIVES. Who needs these kinds of problems? And finally, even among other 4K Static RAM's the 2114 stands out! Not all 4K static Rams are created equal! Some of the other 4K's have **clocked** chip enable lines and various timing windows **just as critical** as Dynamic RAM's. Some of our competitor's 16K boards use these "tricky" devices. But not us! The 2114 is the ONLY logical choice for a trouble-free, straightforward design.

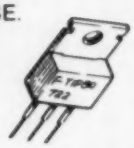
KIT FEATURES:

1. Addressable as four separate 4K Blocks.
2. ON BOARD BANK SELECT circuitry (Cromemco Standard!). Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES.
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets.
8. PHANTOM is jumpered to PIN 67.
9. LOW POWER: under 2 amps TYPICAL from the +8 Volt Buss.
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA—**$33**
LOW PROFILE SOCKET SET—**$12** ASSEMBLED & TESTED—**ADD $30**
SUPPORT IC'S & CAPS—**$19.95** 2114 RAM'S—**8 FOR $69.95**

COMPLEMENTARY POWER TRANSISTORS

SILICON NPN AND PNP. TO-220 CASE.
VCEO - 40V PD - 30 WATTS
FOR AUDIO POWER AMPS, ETC.



TIP29 - NPN
TIP30 - PNP

YOUR CHOICE
3 FOR $1

16K DYNAMIC RAM CHIP

16K X 1 Bits. 16 Pin Package. Same as Mostek 4116-4. 250 NS access. 410 NS cycle time. Our best price yet for this state of the art RAM. 32K and 64K RAM boards using this chip are readily available. These are new, fully guaranteed devices by a major mfg.

VERY LIMITED STOCK!

8 FOR $89.95

NOT ASSOCIATED WITH DIGITAL RESEARCH OF CALIFORNIA, THE SUPPLIERS OF CPM SOFTWARE.

450 NS!

2708 EPROMS

Now full speed! Prime new units from a major U.S. Mfg. 450 N.S. Access time. 1K x 8. Equiv. to 4-1702 A's in one package.

~~$15.75 ea.~~ **$9.95** ~~4 FOR $50.00~~

PRICE CUT

NATIONAL SEMICONDUCTOR ***NEW!***

CAR CLOCK MODULE - #MA6008

$6.99 each

Originally used by HYGAIN to indicate time and channel on an expensive C.B. Mini size, self contained module. Not a Kit. Four digits plus flashing indicator for seconds. Includes MM5369 and 3.58 MHZ crystal for super accurate time base. With hookup data.

INCLUDES CRYSTAL TIMEBASE! WORKS ON 12 VDC!

MFGR's CLOSEOUT LIMITED QTY.

EXPERIMENTER'S HEATING PLATE

Large Manufacturers Surplus. 5¼x10½ in. Made of 3/8 in. tempered glass with heating element laminated on back. Works off 120 VAC. Protected by thermostat and two thermal fuses. Rated 120 Watts. Use for any heating applications. Perfect for heating ferric chloride to increase PC Board etching efficiency. Units are brand new, non-submersible.

WHILE THEY LAST—$2.99 each

MALLORY COMPUTER GRADE CAPACITOR
30,000 MFD 15 WVDC
Small: 3 x 2 Inches
$1.99 ea. 3 For $4.99

New! REAL TIME Computer Clock Chip
N.S. MM5313. Features BOTH 7 segment and BCD outputs. 28 Pin DIP. **$4.95 with Data**

Z-80 PROGRAMMING MANUAL

By MOSTEK, or ZILOG. The most detailed explanation ever on the working of the Z-80 CPU CHIPS. At least one full page on each of the 158 Z-80 instructions. A MUST reference manual for any user of the Z-80. 300 pages. Just off the press.

$12.95

GENERAL INSTRUMENT
FULL WAVE BRIDGE
4 AMP 600 PIV
3/4 IN. SQUARE - WITH LUGS

LOOK!

75¢ ea. 3 FOR $2 RM-1

"THE COLOSSUS"
FAIRCHILD SUPER JUMBO LED READOUT

A full .80 inch character. The biggest readout we have ever sold! Super efficient. Compare at up to $2.95 each from others!

YOUR CHOICE
FND 843 Common Anode
FND 850 Common Cathode
$1.49 ea (6 for $6.95)

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NEW!

CAR CLOCK MODULE - #MA6008

$6.99 each

SPECIAL OFFER: Two for $13

Originally used by HYGAIN to indicate time and channel on an expensive C.B. Mini size, self contained module. Not a Kit. Four digits plus flashing indicator for seconds. Includes MM5369 and 3.58 MHZ crystal for super accurate time base. With hookup data.

INCLUDES CRYSTAL TIMEBASE!
WORKS ON 12 VDC!

MFGR's CLOSEOUT
LIMITED QTY.

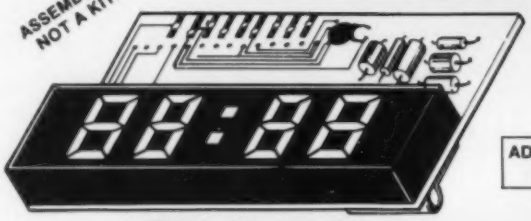
NATIONAL SEMICONDUCTOR

MILITARY TIME FORMAT!

JUMBO CLOCK MODULE

MA1008D
BRAND NEW!

ASSEMBLED, NOT A KIT!



$4.95

REG. $9.95

ADD $1.95 FOR AC XFMR

FEATURES:
- ★ FOUR JUMBO ½ INCH LED DISPLAYS
- ★ 24 HR REAL TIME FORMAT
- ★ 24 HR ALARM SIGNAL OUTPUT
- ★ 50 OR 60 Hz OPERATION
- ★ LED BRIGHTNESS CONTROL
- ★ POWER FAILURE INDICATOR
- ★ SLEEP & SNOOZE TIMERS
- ★ DIRECT LED DRIVE (LOW RFI)
- ★ COMES WITH FULL DATA

ZULU

50% OFF SALE!

PERFECT FOR USE WITH A TIMEBASE.

COMPARE AT UP TO TWICE OUR PRICE!

MANUFACTURER'S CLOSEOUT!

NATIONAL SEMICONDUCTOR

SIX DIGIT ALARM CLOCK CHIP

National's second generation clock chip.
24 Pin Dip. Super easy to use.

FEATURES:
12 HOUR DISPLAY ★ 24 HOUR ALARM
4 OR 6 DIGITS ★ ALARM TONE OUTPUT
SNOOZE ALARM ★ EASY LED INTERFACE
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AM/PM INDICATION ★ SINGLE POWER SUPPLY
FAST AND SLOW SET ★ LOW POWER
HOUSE #
WE SUPPLY FULL DATA, SPECS.
MM5375AA

$2.49 each

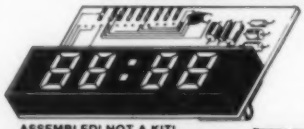
3 FOR $5.95

HUGE SPECIAL PURCHASE!

NATIONAL SEMICONDUCTOR

JUMBO CLOCK MODULE

MA1008A
BRAND NEW!



$6.95

2 FOR $13

(AC XFMR $1.95)

FEATURES
- FOUR JUMBO ½ INCH LED DISPLAYS
- 12 HR REAL TIME FORMAT
- 24 HR ALARM SIGNAL OUTPUT
- 50 OR 60 Hz OPERATION
- LED BRIGHTNESS CONTROL
- POWER FAILURE INDICATOR
- SLEEP & SNOOZE TIMERS
- DIRECT LED DRIVE (LOW RFI)
- COMES WITH FULL DATA

ASSEMBLED! NOT A KIT!

MANUFACTURER'S CLOSEOUT!

PERFECT FOR USE WITH A TIMEBASE.

COMPARE AT UP TO TWICE OUR PRICE!

MICRO-MINI TOGGLE SWITCH

SPDT. By RAYTHEON. MADE IN USA! WITH HDWR.

99¢ EACH

6 FOR $5

---

60 Hz CRYSTAL TIME BASE

$4.95 (Complete Kit)

Uses MM5369 CMOS divider IC with high accuracy 3.579545 MHZ Crystal. Use with all MOS Clock Chips or Modules. Draws only 1.5 MA. All parts, data and PC Board included.

FET SALE

2N4304. Brand New N Channel, Junction Fet. BVGD0-30V IDSS-15 MA Typ. 1500 uMHOS. TO-18 Plastic Case. Mfg. by Teledyne.

6 FOR $1

FAIRCHILD PNP "SUPER TRANSISTOR"

2N4402. TO-92 Plastic. Silicon PNP Driver. High Current. VCEO-40 HFE-50 to 150 at 150 MA. FT-150 MHZ. A super "BEEFED-UP" Version of the 2N3906.

8 FOR $1

JUMBO IC ASSORTMENT

All new not rejects. BIG computer mfg. Surplus. Some standard marked, many house numbered. TTL, DTL, LINEAR. All prime. 1st line.

50 for $1.59 500 for $12.95

MORE CLOCK CHIPS!

MM5316 - 4 Digit W/Alarm. An old reliable, work horse chip — **$1.99**

MK50380 - 4 Digit - Direct Drive on Readouts. Like FCM 7010 — **$1.99**

MK50250 - 6 Digits with Alarm. For multiplexed Led R.O. — **$2.95**

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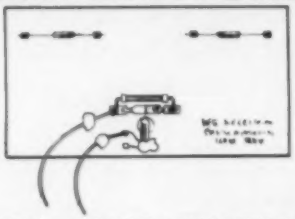
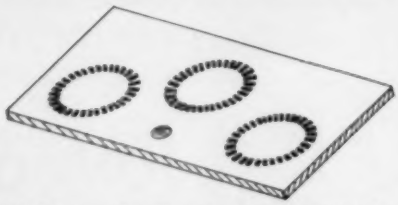
85 TON SURPLUS DEAL!!!

170,000 pounds of new surplus electronics was too much for either Digital Research Corporation or Bullet Electronics to handle ALONE! So we pooled our resources and rolled a convoy of four eighteen wheelers into our new Texas warehouse. You may order any of the **below** items from **either** company along with any other items from our respective ads elsewhere in 73. However, please DO NOT order Bullet Kits from Digital Research, or vice-versa.

TEMPERATURE CONTROLLED HEATING PLATE



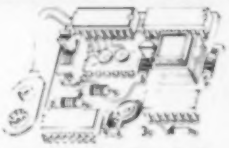
$2.99



5⅜ x 10⅜ In. 120 VAC, 120 WATTS. Made of 1/4 In. tempered plate glass with Ni-Chrome heating element laminated to back. Element size is 4¼ x 9¼ Inches. Double protected by TI KLIXON Thermostat and two thermal fuses. Each also has neon ready light.

Besides the obvious use as a bun warmer, food warmer, coffee warmer, glue warmer, etc., our tests show this plate to be an excellent warmer for ferric chloride solution used in etching PC Boards by hobbyists. Typically increases etching efficiency by 300% over room temperature. Non-Submersible.

CMOS PARTS BONANZA



99¢ EACH

Complete Module: 2 x 1¾ In.

Contains: MC14553 3 DIGIT BCD COUNTER, MC14511 BCD to 7 segment decoder latch, CD4060 OSCILLATOR and RIPPLE COUNTER, CD4011 Nand gate. Also was square N.O. push button, 9V battery clip, SPDT Sub-Mini slide switch. Plus misc. resistor, caps, transistor. All parts easily removed. Reg. Dist. List on MC14553 alone is over $4 each!

FIBER POINT PENS

Writes on almost anything. Water Soluble ink. Designed to write on plastic etc. Black. Fine Tip. 49¢ Value.

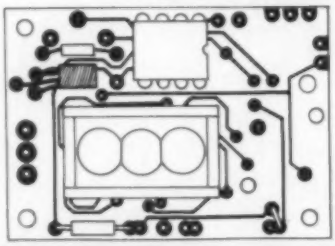
SPECIAL: 6/$1 100/$14

PUSH BUTTON SWITCH

N.O. SPst. P.C. Mount. Same as used on CMOS Parts Bonanza at left.

5 FOR $1

4 BIT MICROPROCESSOR MODULE



75¢ (MODULE ONLY) **3 FOR $2**

Originally custom designed for a large US Consumer Mfg. These were used as part of a weight loss program. Unit counts up to 25 bites with 24 flashes between bites to indicate chewing rate. Has 2 Digit LED readouts, adjustable on board oscillator. 4 Bit Microprocessor with PROM. Our experimentation shows this module has many applications for timing, pacing, etc. Also there are on board signals that can produce various beeping, warble and exotic tones. Some application data included. Complete units in case, as above: **$2.49 each.**

74C903 CMOS:

National Semiconductor. New CMOS Part. Hex Inverting Buffer. Use for interface from PMOS to TTL or CMOS. Can Drive LED'S. **6/$1**

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sale

Harris HA2625 Phase Lock Loop 14 pin dip	.99
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SAJ110 Seven Stage Frequency Divider w/specs	3/1.00
5025J Monsat 6 Digit Chip w/specs 28 pin dip	1.95
MAN84 Common Anode Readout Large Character	0/4.00
FND359 Common Cathode Readout .4" Character	0/3.75
FND70 Common Cathode Readout .3" Character	.50
FND71 Common Cathode ±1 Character Matches FND70	.65
TIP-30 PNP 30W Vceo-40V IC-1A Tab mount TO-220	3/1.00
2N4400 NPN Gen. Purpose Similar to 2N3904	3/1.00
2N4402 PNP Compliment to 2N4400	3/1.00

UNIVERSAL SOUND EFFECTS BOARD

HAVE YOU EVER WISHED YOU COULD DUPLICATE THE SOUND OF A STEAM TRAIN OR A PHASOR GUN? HOW ABOUT GUNSHOTS, WHISTLES, SIRENS, BARKING DOGS AND OTHER SOUND EFFECTS? NOW YOU CAN WITH OUR PROGRAMMABLE SOUND EFFECTS KIT. IT USES THE NEW 28 PIN T.I. SOUND SYNTHESIZER CHIP, SN76477 AND SUPPORT CIRCUITRY. 5 TO 12VDC IS REQUIRED TO GIVE APPROX. 1/4 WATT OF AUDIO OUTPUT. WE PROVIDE THE P.C. BOARD, PARTS AND INSTRUCTIONS ALONG WITH A CHART TO PROGRAM SOME COMMON SOUNDS. USE YOUR IMAGINATION TO CREATE ORIGINAL SOUND EFFECTS. ORDER: SE-01 **16.95**(Less Spkr.) 3/39.95

YOU'VE SEEN IT ON QUALITY STEREO GEAR

SUPER DEAL!

BLACK INSERT

BRUSHED CHROME

7/8" hole to hole

DPDT Toggle ALCO CBT-202 3A @ 125V

.49

MC1469R POSITIVE VOLTAGE REGULATOR

1 AMP. COMPLETE SPECS AND APPLICATIONS SHOW HOW TO BUILD FIXED OR VARIABLE POWER SUPPLIES FROM 3 TO 30VDC. DRIVE EXTERNAL SERIES PASS FOR CURRENT TO 20 AMPS!

1.35 EA. 10/10.00

25A 100V SCR 1.95

Perfect for battery chargers, switching supplies, crowbars, etc.

739 FAIRCHILD

DUAL LOW NOISE AUDIO PRE-AMPLIFIER

89¢ 2/1.69

2N5484 N Channel J-FET VHF/UHF Amp to 400MHZ TO-92 .59

MPF131 N-CHANNEL DUAL GATE MOSFET 59¢

DESIGNED FOR AMPLIFIER AND MIXER APPLICATIONS TO 200 MHZ. PLASTIC CASE. UNITS ARE HOUSE NUMBERED WITH SPECS.

MJ900 - MJ1000

COMPLIMENTARY PNP NPN DARLINGTON POWER TRANSISTORS. 8 AMPS. WE SUPPLY A SCHEMATIC TO BUILD A HIGH POWER (25W) LOW DISTORTION AUDIO AMP WITH ONLY ONE ADDITIONAL TRANSISTOR AND A DOZEN INEXPENSIVE COMPONENTS! TO-3 CASE STYLE. BUY A PAIR FOR

$3.00!

FANTASTIC SOUND EFFECTS CHIP

THIS 28 PIN MARVEL CONTAINS A LOW FREQUENCY OSCILLATOR, VCO, NOISE OSCILLATOR, ONE SHOT, MIXER AND ENVELOPE CONTROL, WITH 8 PAGE MANUAL. 5 to 9VDC 3.95

EMITTER RESISTORS

HARD TO FIND VALUES!

.1 ohm @ 5W

7/1.00

LM3900 QUAD NORTON AMP

WE BOUGHT A LARGE QUANTITY OF THESE HOUSE NUMBERED PARTS AT A BARGAIN PRICE THAT ALLOWS US TO SELL THEM AT A LOW LOW .39¢

IL-1 OPTO ISOLATORS

BY LITRONIX 6 PIN DIP. STANDARD PINOUT LED-TRANSISTOR COMBINATION 59¢ WHILE THEY LAST!

WIREWRAP Wire

30 Gauge KYNAR® Insulat.

500 FT

4.50

6 DIGIT ZULU CLOCK KIT

At last a clock for HAMS. Designed with large bright LED digits to enhance your shack. The unit is a pleasure to assemble and so easy on the budget! You get top quality parts and plated PC Boards. The unique design of the board set eliminates the headaches of running wires between clock and readout board. As a bonus the unit has a switchable timer that can be reset to zero without disturbing real time. Elapsed time in minutes and seconds up to 25 minutes. Six full sized FND510 readouts and colons making viewing easy from across the room. Does NOT use the old style 5314 chip. **DUE TO A SPECIAL PURCHASE WE HAVE A LIMITED QUANTITY.**

We Promised!

COMPLETE ZULU CLOCK KIT

Includes: All components, plated, drilled PC Boards, large easy to read instructions, and AC transformer. Clock board: 2¾" X 4¾ Readout Board: 1½" X 4¾"

10.00

24 Hr. Format Only

Hand made solid hardwood case for the Zulu Clock. Includes ruby front filter and back panel.

6.95

ALL COMPONENTS 100% GUARANTEED

CA3011 WIDEBAND IF AMP w/specs	50¢
2N3569 NPN EPOXY 1W	6/1.00
741 OP AMP 8 PIN DIP	5/1.00
723 VOLTAGE REG. 14 PIN DIP	50¢
MPS8530 NPN HOUSE ++	8/1.00
725 OP AMP LOW NOISE HOUSE +	99¢
7815 15V 1A REGULATOR HOUSE ◊	69¢
2N4343 P CHANNEL J FET	4/1.00
2N5111 PNP MED PWR 40W TO-220	3/1.00
2N6027 PROGRAMMABLE UNIJUNCTION w/specs	50¢
TRIAC 200V SX UNMARKED	3/1.00

Diodes

1N4003	200V 1A	10/1.00
1N4006	800V 1A	13/1.00
1N270	Germanium Diode	8/1.00
1N38A	Germanium Diode	10/100
1N4148	Cut & Bent for PC Board Insertion	100/1.25

UNMARKED POWER DIODES with cathode bands. Guaranteed to be at least 400PIV @ 1A. 100% Good parts. Epoxy case.

25/1.00

WARBLE ALARM KIT

A fun EASY kit to assemble that emits an ear piercing 10 watt dual tone scream. Resembles European siren sound. Great for alarms or toys. Operates from 9–12VDC at up to 1 amp fusing 12VDC+8 ohm speaker). Over five thousand have been sold. All parts including PC board, less speaker. **2.50** ORDER WB-02

POWER SUPPLY KIT PS-14

- Better than 200MV load and line regulation
- Foldback Current Limiting
- Short Circuit Protected
- Thermal Shutdown
- Adjustable Current Limiting
- Less than 1% ripple.
- 15 amps 11.5 to 14.5V
- All parts supplied including heavy duty transformer.
- Quality plated fiberglass PC board.

Less Case, meters & jacks

UPS SHIPPING PAID!

REVIEWED IN 7/78 73 MAG.

15A CONT. 20A INT. 42.95

MV1824 Varicap Diode 10pfd Nom. 2:1 Tuning Range 49¢

2N5583 High Freq. Amp 1 Watt @ 1.5 GHZ! TO-5 Case style, House # 59¢

MPC4000B ¼ Watt Audio Amp 4 pin plastic pack 59¢

H11S1 100V 3A SCR Ultra sensitive gate drives from TTL. TO-220 69¢

H4035 50V 3A Triac Sensitive Gate TO-5 49¢

FND510 .56"

COMMON ANODE READOUT CHARACTER

LIMIT 24 PER CUSTOMER

LED'S JUMBO RED 5/.99 GREEN 4/.99

MEDIUM RED .15 5mm RED .10 GREEN .10 YELLOW .10

1.5V 10-30 ma

MC1351P FM-IF AMP AND DISCRIMINATOR

USED IN FM & TV SOUND CIRCUITS. REQUIRES MINIMUM EXTERNAL COMPONENTS. 14 PIN DIP. DIRECT REPLACEMENT FOR HEPC 6060, ECG 748 and MANY OTHERS. HOUSE # WITH SPECS 50¢

MC3301P HOUSE # 4

4 OP AMPS IN ONE PACKAGE. USES SINGLE SUPPLY, 4 to 28VDC. INTERNALLY COMPENSATED. SIMILAR TO MC3401 BUT HIGHER GAIN. 49¢

OVERVOLTAGE PROTECTION KIT

6.95

Provides cheap insurance for your expensive equipment. Trip voltage is adjustable from 3 to 30 volts. Overvoltage instantly fires a 25A SCR and shorts the output to protect equipment. Should be used on units that are fused. Directly compatible with the PS-12 and PS-14. All electronics supplied. Drilled and plated PC board. (Order OVP-1)

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SMALL DISC!

2500 MFD @ 16 VDC RADIAL 3/1.00

330 MFD @ 50V Electrolytic 5/1.00 Radial

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.022 @ 100VDC Mylar 8/1.00

.22 @ 50VDC Mylar 6/1.00

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22mfd @ 20V Dip Tant 4/1.00

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NEVER A SWEETER METER!

Beautiful **American made** panel meters are a snap to install. Huge 3½" wide dials are easy to read. You would expect to pay more for each than we get for the pair! MATCHED SET 0-15VDC, 0-30ADC

12.95 *Set*

MK-03A CLOCK/TIMER KIT

Features 24 hour Zulu time and up to 24 hours of elapsed time on the same set of six digit LED readouts. Totally independent operation of both functions. Clock has pre-settable alarm with 10 minute snooze. Timer has reset, hold, and count functions. Full noise and overvoltage protection. 24 hour only. Readouts has dimmer feature or they can be turned off without disturbing the clock or timer. Timebase included (.01% accuracy). Because of the many options and mounting considerations the case and switches are not included. Switches are standard types. Will fit inside standard aircraft instrument case.

9–14VDC 28.95

New Items

72301	General Purpose Op Amp 8 Lead Can	3/1.00
72733	Volt. Reg. IC (Texas Instruments) 10 Lead Can	.89
13741	FET Input 741 Op Amp Has. # Mini Dip	3/1.10
6-36 PFD	Ceramic Trimmer Cap Small & Stable	.45 10/3.00

56,000 MFD

15 Volts Computer Grade Cap 3½" height 2.10 10/18.00

3.3mfd 6.3VDC Dip Tantalum (Import) Radial Leads 12/1.00

See You in DAYTON !

ZENER GRAB BAG

A very nice assortment of ¼, ½ & 1W zeners. Voltage ranges are from **2.7** to **30 VDC.** Most have house # but we provide a cross over list to standard numbers. A great buy for any shop. **12 different types.**

50¢

- NO COD'S
- SEND CHECK OR MONEY ORDER OR CHARGE CARD NO.
- ADD 5% FOR SHIPPING
- TEX RESIDENTS ADD 5% TAX
- FOREIGN ORDERS ADD 10%,
- ORDERS UNDER $10. ADD .75 for HANDLING

PHONE ORDERS ACCEPTED ON VISA & MC

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WE HAVE A RAM FOR EWE...

. . . And we're not pulling the wool over your eyes, although we do feel a little sheepish about including this many puns in the ad copy. We're offering the popular **2102 1K** static RAM at only **$9.90** for ten of them (sorry, we can't sell single units at this price). These are low power parts that will work with any 2 MHz CPU system . . . but they're going pretty fast, so stock up now.

SOCKETS

Tin plated, low profile, soldertail types:

SKL8	8 pin	10/$1.85
SKL14	14 pin	10/$1.95
SKL16	16 pin	~~10/$2.10~~
SKL18	18 pin	8/$2.25
SKL20	20 pin	8/$2.75
SKL22	22 pin	8/$2.95
SKL24	24 pin	3/$1.10
SKL36	36 pin	5/$1.75
SKL40	40 pin	2/$1.25

"PACKER BILL" SPECIAL: 12/$2.00

3 level wire wrap, gold plated types:

SK3W1414	pin	10/$3.85
SK3W1616	pin	10/$4.25
SK3W1818	pin	$0.75 ea.
SK3W2020	pin	$0.88 ea.
SK3W2222	pin	$1.00 ea.
SK3W2424	pin	$1.00 ea.
SK3W2828	pin	$1.35 ea.
SK3W3636	pin	$1.55 ea.
SK3W4040	pin	$1.75 ea.

MA1003 CLOCK AND CASE SPECIAL: $19.95!

It's hard to find a clock that's easier to build than this one . . . or one that's more versatile. Module includes built-in time base — ideal for portable or mobile operation. Requires 12 VDC, either batteries or AC adapter. Readouts are blue-green fluorescent types that don't wash out like LEDs do. Our matching case includes an optical filter to bring out the best in the readouts, as well as mounting hardware for attaching case to dashboard etc.

The MA1003 module is available separately for $16.50; the case is available separately for $5.95.

12 VOLT, 8 AMP POWER SUPPLY KIT $44.50

12A capacity with 50% duty cycle, foldback current limiting, crowbar overvoltage protection, many more features. For transceivers, portable tape/TV equipment, disk drives, etc. Easy to assemble — except for transformer, diodes, and filter caps, all parts mount on heavy-duty circuit board. Does not include case. One of our all time best sellers . . . probably because it works, and works well, for a long time.

BIPOLAR POWER SUPPLY KIT: $15.00

This highly cost-effective unit gives you a tightly regulated ¼ Amp or more per side. Includes transformer, circuit boards, and all parts, but less case and line cord. **Specify project #13 and choice of voltage** — either ±5, 6, 8, 9, 12, or 15 Volts. Excellent for op amp experimentation, music synthesizers, etc.

PET ROCKS (some people call them crystals)

XT500K	500 KHz, series mode, fundamental, wire leads, HC6/U package . . . **$4.95**
XT1M	1 MHz, otherwise same as above . . . **$5.95**
XT1.84320	1.84320 MHz, otherwise same as above . . . **$5.95**
XT2M	2 MHz, otherwise same as above . . . **$5.95**
XT3.58M	3.58 MHz colorburst crystal, otherwise same as above . . . **$2.25**
XT4M	4 MHz, series mode, fundamental, HC18 package . . . **$4.95**
XT4.5315M	4.5315 MHz, otherwise same as above . . . **$4.95**
XT5M	5 MHz, otherwise same as above . . . **$4.95**
XT8M	6 MHz, otherwise same as above . . . **$4.95**
XT9M	9 MHz, otherwise same as above . . . **$4.95**
XT10M	10 MHz, otherwise same as above . . . **$4.95**
XT12M	12 MHz, otherwise same as above . . . **$4.95**
XT15M	15 MHz, otherwise same as above . . . **$4.95**
XT18M	18 MHz, otherwise same as above . . . **$4.95**
XT20M	20 MHz, otherwise same as above . . . **$4.95**

TERMS: Add $1 handling to orders under $15. Allow up to 5% shipping, excess refunded. Allow more for power supplies. Please include street address for UPS delivery. Prices good through cover month of magazine. VISA® /Mastercharge® call our 24 hour order desk at **(415) 562-0636.** CODs OK with street address. Cal. res. add sales tax. **THANKS FOR YOUR BUSINESS!**

G4

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— Completely Assembled —
— Battery Operated —

The ASI Transistor Checker is capable of checking a wide range of transistor types, either "in circuit" or out of circuit. To operate, simply plug the transistor to be checked into the front panel socket, or connect it with the alligator clip test leads provided. The unit safely and automatically identifies low, medium and high-power PNP and NPN transistors. Size: 3¼" x 6¼" x 2".
"C" cell battery not included.

NEW! Trans-Check $29.95 ea.

Custom Cables & Jumpers

NEW! NEW!

DB 25 Series Cables

Part No.	Cable Length	Connectors	Price
DB25P-4-P	4 ft.	2-DP25P	$15.95 ea.
DB25P-4-S	4 ft.	1-DP25P/1-25S	$16.95 ea.
DB25S-4-S	4 ft.	2-DP25S	$17.95 ea.

Dip Jumpers

DJ14-1	1 ft.	1-14 Pin	$1.59 ea.
DJ16-1	1 ft.	1-16 Pin	1.79 ea.
DJ24-1	1 ft.	1-24 Pin	2.79 ea.
DJ14-1-14	1 ft.	2-14 Pin	2.79 ea.
DJ16-1-16	1 ft.	2-16 Pin	3.19 ea.
DJ24-1-24	1 ft.	2-24 Pin	4.95 ea.

For Custom Cables & Jumpers, See JAMECO 1979 Catalog for Pricing

CONNECTORS
25 Pin-D Subminiature

DB25P (as pictured)	PLUG (Meets RS232)	$2.95
DB25S	SOCKET (Meets RS232)	$3.50
DB51226-1	Cable Cover for DB25P or DB25S	$1.75

PRINTED CIRCUIT EDGE-CARD

156 Spacing Tin-Double Read-Out — Bifurcated Contacts — Fits .054 to .070 P.C. Card

15/30	PINS (Solder Eyelet)	$1.95
18/36	PINS (Solder Eyelet)	$2.49
22/44	PINS (Solder Eyelet)	$2.95
50/100 (.100 Spacing)	PINS (Wire Wrap)	$6.95
50/100 (.125 Spacing)	PINS (Wire Wrap) RG81-1	$5.95

Solar Cells 2x2cm

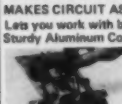
- 0.4 volts
- 100mA
- 41 MW

Can be added in series for higher voltage or parallel for higher current.

#SC 2x2 $1.95 ea. or 3/$5.00

the 3rd Hand

MAKES CIRCUIT ASSEMBLY A BREEZE!
Lets you work with both hands. Sturdy Aluminum Construction. **$9.95 ea.**



- Clamp "3rd Hand" on edge of bench, table or workboard. Insert circuit board, position components.
- Flip circuit board to flat position for soldering and clipping.

- Bright .300 ht. comm. cathode display
- Uses MM5314 clock chip
- Switches for hours, minutes and reset minutes
- Hrs. easily viewable to 20 ft.
- Simulated walnut case
- 115 VAC operation
- 12 or 24 hr. operation
- Incl. all components, case & wall transformer
- Size: 6¾" x 3-1/8" x 1¾"

JE701
6-Digit Clock Kit $19.95

REMOTE CONTROL TRANSMITTER & RECEIVER

$19.95

INSTRUMENT/CLOCK CASE

This case is an injection molded unit that is ideal for uses such as DVM, COUNTER, or CLOCK cases. It has dimensions of 4½" in length by 4" in width by 1-9/16" in height. It comes complete with a red bezel.

PART NO: IN-CC $3.49 each

MICROPROCESSOR COMPONENTS

6800A/6800A SUPPORT DEVICES

6800A	CPU	$ 9.95
6810	8-Bit Input/Output	3.25
6214	Priority Interrupt Control	5.95
6216	Bi-Directional Bus Driver	3.49
6224	Clock Generator/Driver	3.95
6226	Bus Driver	3.49
6228	System Controller/Bus Driver	5.95
6238	System Controller	5.95
6251	Prog. Comm. I/O (USART)	7.95
6253	Prog. Interval Timer	14.95
6255	Prog. Periph. I/O (PPI)	8.95
6257	Prog. DMA Control	19.95
6259	Prog. Interrupt Control	19.95

6800/6500 SUPPORT DEVICES

MC6800	MPU	$14.95
MC6802CP	MPU with Clock and Ram	24.95
MCM6810AP1	128X8 Static Ram	5.95
MC6821	Periph. Inter Adapt (MC6520)	7.49
MC6828	Priority Interrupt Controller	12.95
MCM6830L8	1024X8 Bit ROM (MCM6830-8)	14.95
MC6850	Asynchronous Comm. Adapter	7.95
MC6852	Synchronous Serial Data Adapt.	9.95
MC6840	0-400 bps Digital MODEM	12.95
MC6852	2400 bps Modulator	14.95
MCM6846A	Quad 3-State Bus Trans. (MC8726)	2.25

MICROPROCESSOR CHIPS—MISCELLANEOUS

Z80(780C)	CPU	$19.95
Z80A(780-1)	CPU	24.95
CDP1802	CPU	19.95
2650	MPU	19.95
8035	8-Bit MPU w/clock, RAM, I/O lines	19.95
P8085	CPU	19.95
TMS9900JL	16-Bit MPU w/hardware, multiply & divide	49.95

SHIFT REGISTERS

MM5004H	Dual 25 Bit Dynamic	$.50
MM5005H	Dual 50 Bit Dynamic	.50
MM5040H	Dual 16 Bit Static	.50
MM5064H	Dual 100 Bit Static	.50
MM5109H	Dual 64 Bit Accumulator	.50
MM5016H	608/512 Bit Dynamic	.99
2504/7	1024 Dynamic	3.95
2516	Hex 32 Bit Static	4.95
2527	Dual 132 Bit Static	2.95
2564	512 Static	.99
2565	1024 Dynamic	2.95
2527	Dual 256 Bit Static	2.95
2529	Dual 250 Static	4.50
2529	Dual 240 Bit Static	4.00
2532	Quad 80 Bit Static	2.95
2533	1024 Static	2.95
3341	Fifo	5.95
74L3670	4X4 Register File (TriState)	2.49

UART'S

A-Y-5-1013	30K BAUD	5.95

MICROPROCESSOR MANUALS

M-280	User Manual	$7.00
M-CDP1802	User Manual	7.50
M-2650	User Manual	5.00

ROM'S

2513(2140)	Character Generator(upper case)		23.95
2513(3021)	Character Generator(lower case)		9.95
2516	Character Generator		10.95
MM52304	2048-Bit Read Only Memory		1.95

RAM'S

1101	256X1	Static	$1.49
1103	1024X1	Dynamic	.99
2101(8101)	256X4	Static	3.95
2102	1024X1	Static	1.75
2102	1024X1	Static	1.95
2111(8111)	256X4	Static	3.95
2112	256X4	Static MOS	4.95
2114	1024X4	Static 450ns	9.95
2114L	1024X4	Static 450ns low power	10.95
2114-3	1024X4	Static 300ns	10.95
2114L-3	1024X4	Static 300ns low power	11.95
5101	256X4	Static	7.95
5280-2107	4096X1	Dynamic	4.95
7489	16X4	Static	3.75
74S289	256X1	Static Tristate	4.95
93421	256X1	Static	2.95
UPD414 (MM4027)	4K	Dynamic 16 pin	4.95
UPD416 (MM4116)	16K	Dynamic 16 pin	14.95
TMS4044-45NL	4K	Static	14.95
TMS4045	1024X4	Static	14.95
2117	16,384X1	Dynamic 350ns (Reduce marked)	9.95
MM5262	2KX1	Dynamic	4/1.00

PROM'S

1702A	256X8	FAMOS	$5.95
TMS2516	16K*	EPROM(Intel 2716)	49.95
(2716)	*Requires single +5V power supply		
TMS2532	4K8X8	EPROM	69.95
2708	8K	EPROM	10.95
2716 T.I.	16K**	EPROM	29.95
	**Requires 3 voltages, —9V, +5V, +10V		
5305	256X8	FAMOS	14.95
6301-1(7611)	1024	Tristate Bipolar	3.49
6330-1(7602)	256	Open C Bipolar	2.95
82S23	32X8	Open Collector	3.95
82S115	4096	Bipolar	19.95
82S123	32X8	Tristate	3.95
74186	512	TTL Open Collector	9.95
74188	256	TTL Open Collector	3.95
74S287	1024	Static	2.95

The Incredible "Pennywhistle 103"

$139.95 Kit Only

The Pennywhistle 103 is capable of recording data to and from audio tape without critical speed requirements for the recorder and it is able to communicate directly with another modem and terminal for telephone "teaming" and communications. In addition, it is free of critical adjustments and is built with non-precision, readily available parts.

Data Transmission Method	Frequency-Shift Keying, full-duplex (half-duplex selectable)
Maximum Data Rate	300 Baud.
Data Format	Asynchronous Serial (return to mark level required between each character).
Receive Channel Frequencies	2025 Hz for space, 2225 Hz for mark.
Transmit Channel Frequencies	Switch selectable: Low (normal) — 1070 space, 1270 mark. High — 025 space, 2225 mark.
Receive Sensitivity	—46 dBm accurately coupled.
Transmit Level	—15 dBm nominal. Adjustable from —6 dBm to —20 dBm.
Receive Frequency Tolerance	Frequency reference automatically adjusts to allow for operation between 1800 Hz and 2400 Hz.
Digital Data Interface	EIA RS-232C or 20 mA current loop (receive is optoisolated and non-polar).
Power Requirements	120 VAC, single phase, 10 Watts.
Physical	All components mount on a single 5" by 9" printed circuit board. All components included.

Requires a VDM, Audio Oscillator, Frequency Counter and/or Oscilloscope to align.

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K. Kit comes complete with:

- 8 each UPD416-1 (16K Dynamic Rams) 250NS
- Documentation for conversion

TRS-16K $99.95

COMPUTER CASSETTES

- 6 EACH 15 MINUTE HIGH QUALITY C-15 CASSETTES
- PLASTIC CASE INCLUDED
- 12 CASSETTE CAPACITY
- ADDITIONAL CASSETTES AVAILABLE @C-15-$2.50 ea

CAS-6 $14.95 (Case and 6 Cassettes)

CSC CONTINENTAL SPECIALTIES PROTO BOARDS

Proto Board 203

A total ready-to-use power breadboard accessory device with a built-in regulated, short-proof power supply. Just plug in and start building! 2 extra floating 5-way binding posts for external inputs. Self-contained with power switch, indicator lamp and power fuse. 20-14 pin DIP capacity. An expensive look more quality unit. All metal construction. 8¾"L x 6¾"W x 2¾"H. 3 lbs.

PB 203 **$75.00**

Model Number	L x W x H (Inches)	Price
PB-6	6.0 x 4.5 x 1.4	$19.95
PB-100	6.0 x 4.5 x 1.4	$19.95
PB-101	6.0 x 4.5 x 1.4	$22.95

Proto Board 203A

All the features of the PB-203 plus additional power supply flexibility, provides 7½ Regulated 5VDC supply (same specifications as PB-203). Also, variable adjustable +10VDC and —15 VDC 0.5A supplies, each with externally and independently adjustable output voltage. Ripple and noise of + and —15V supplies, 50mV at 0.25A.

PB 203A **$124.95**

Model Number	L x W x H (Inches)	Price
PB-102	7.0 x 4.5 x 1.4	$26.95
PB-103	9.0 x 6.0 x 1.4	$44.95
PB-104	9.0 x 8.0 x 1.4	$54.95

SUP 'R' MOD II
UHF Channel 33 TV Interface Unit Kit

- Wide Band B/W or Color System
- Converts TV to Video Display for home computers, CCTV camera, Apple II, works with Cromemco Dazzler, SOL-20, IMS-80, Challenger, etc.
  MOD II is pretuned to Channel 33 (UHF).
- Includes coaxial cable and antenna transformer

MOD II $29.95 Kit

B&K PRECISION 3½-Digit Portable DMM

- Overload Protected
- .3" high LED Display
- Battery or AC operation
- Auto Zeroing
- 1 mv, 1½, 0.1 ohm resolution
- Overrange reading
- 10 meg input impedance
- DC Accuracy 1% typical

Ranges: DC Voltage 0-1000V AC Voltage 0-1000V Freq. Response 50-400 HZ DC/AC Current 0-100mA Resistance 0-10 meg ohm Size 6.4" x 4.4" x 2"

Accessories:

AC Adapter DC-20	$9.00
Rechargeable Batteries BP-35	20.00
Carrying Case LC-28	7.50

Model 2800 $99.95
Comes with test leads, operating manual and spare fuse.

CSC 100 MHz 8-Digit Counter

- 20 Hz-100 MHz Range
- 8" LED Display
- Crystal-controlled timebase
- Fully Automatic
- Portable — completely self-contained
- Size — 1.75" x 7.38" x 5.63"
- Four power sources, i.e. batteries, 110 or 220V with charger 12V with auto lighter adapter and external 7.2-10V power supply

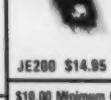
MAX-100 $134.95

ACCESSORIES FOR MAX 100:

Mobile Charger Eliminator use power from car battery	Model 100 — CLA $3.95
Charger/Eliminator use 110 V AC	Model 100 — CAI $9.95

REGULATED POWER SUPPLY (NEW)

JE200 5V-1 AMP POWER SUPPLY



- Uses LM309K
- Heat sink provided
- PC Board construction
- Provides a solid 1 amp @ 5 volts
- Can supply up to ±5V, ±9V and ±12V with JE205 Adapter
- Includes components, hardware & instructions
- Size: 3½"x3"x2"H

JE200 $14.95

JE205 ADAPTER BOARD — Adapts to JE200 — ±5V, ±9V and ±12V

- DC/DC converter w/ +5V input
- Toriodal hi-speed switching XMFR
- Short circ. protection
- PC Brd. construction
- Piggy-back to JE200 board
- Size: 3½"x2"x 9/16"h

JE205 $12.95

$10.00 Minimum Order — U.S. Funds Only
California Residents — Add 6% Sales Tax

Spec Sheets — 25¢
1979 Catalog Available—Send 41¢ stamp

FREE 1979 Catalog

Jameco ELECTRONICS J1

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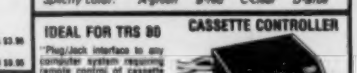
ADVERTISED PRICES GOOD THRU JUNE

ELIT-WRAP

Model P180 includes 2-100' spools #28 AWG wire wrap wire



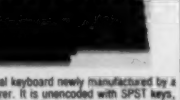
Supplies insulated wire from spool to wrap-posts without pre-trim-ping and precutting using "daisy chain" method.

Model P180 Tool $24.50

P180A Replacement Bit	$12.95
W28-2 Replacement wire (3 spool pkg.)	$2.75 ea.

Specify color: A-green B-red C-clear D-Blue

IDEAL FOR TRS 80 CASSETTE CONTROLLER

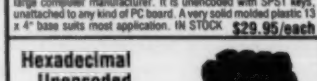


"Plug/Jack interface to any computer system requiring remote control of cassette functions"

The DC100 controls cassette motor functions, monitors tape location with its internal speaker and requires no power. Eliminates the plugging and unplugging of cables during computer loading operation from cassette.

#CC-100 **$29.50**

63-Key Unencoded Keyboard



This is a 63-key, terminal keyboard newly manufactured by a large computer manufacturer. It is unencoded with SPST keys, unattached to any kind of PC board. A very solid molded plastic 13 x 4" base suits most application. IN STOCK **$29.95/each**

Hexadecimal Unencoded Keypad

19-key pad includes 1-10 keys, ABCDEF and 2 optional keys and a shift key. **$10.95/each**

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A50

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"ONE CENTERS"

THIS SALE IS OFFERED BY POLY PAKS EXCLUSIVELY

SALE

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When ordering, always use catalog number, type no., the name of the magazine you are ordering from and the month.

40 CHANNEL CB BOARD

$9.99

2 for $18

Poly Paks buys up factory close-out from Hy gain so you gain! Boards have Heatsunked 9 Watt Amp Chip, RF and Mod. Transistors, and National Semi MM series PLL. May be used for 10 meter conversion (use 6 month series "CB to 10" in 73 Mag.) The parts alone make it an offer you can't refuse.

Cat. No. 92CU6680

"BEEM -O- LIGHT" LASER DIODES

LASD-89 style, N-type. Designed in Hetero-junction Coax structure, for PULSE mode operation. Rated @ 8-9 Watts. Wavelength 904 nm. (approx.) Typ. Forward V (peak): 12V. Max. For Cur. 60 A. SIZE .25" x 7/8"

$5.99

Cat. No. 92CU3300

2 for $6

MOTOROLA STYLE "SANDY DISC" 10 AMP RECTIFIERS

	PIV	SALE	2 FOR
☐	50	.35	.65
☐	100	.45	.85
☐	200	.65	1.25
☐	400	.79	1.50
☐	600	.99	1.89
☐	1000	1.19	2.25

- Axial Leads
- Only ¼" Thick
- Heavy Sand Type Hermet Construction
- Space Age Environmental Characteristics

Cat. No. 92CU6877 (Specify Voltage)

"ONE PENNY MORE GETS YOU TWO" MINI LECTROS

- Axial Leads, Plastic

MFD.	VOLTS	SALE	2 FOR
25	15	.14	.15
25	25	.17	.18
25	50	.24	.25
50	15	.17	.18
50	25	.19	.20
50	100	.31	.32
100	10	.23	.24
100	25	.25	.26
100	50	.35	.36
100	100	.39	.40
150	15	.23	.24
200	15	.24	.25
220	25	.32	.33
220	50	.39	.40
250	25	.33	.33
250	50	.45	.46
300	15	.31	.32
300	25	.33	.34
500	15	.33	.34
500	25	.36	.37
500	50	.39	.40
1000	15	.35	.36

Order by Cat. No. 92CU5718 and Value

LEDS!

YOUR CHOICE 6 for $1.29
10 SALE 12 for $1.50

Order by Cat. No.

☐	1706	MICRO TOPHAT RED
☐	1962	MED YELLOW STUBBY
☐	1902	JUMBO SINGLE PIN RED
☐	1732	JUMBO Amber
☐	1702	JUMBO RED
☐	1739	JUMBO GREEN
☐	1720	MICRO RED
☐	1790	JUMBO RED CLEAR

- 25-DTL FAIRCHILD IC's, gates and flip flops, Dip, 100% (#3709) ... 1.29 — 50 for 1.30
- 1-24 VOLT 50 MIL. TRANSFORMER, 115V input, open frame, 1x1x3/4" (#5631) ... 1.29 — 2 for 1.30
- 5-SPST PUSHBUTTON MOMENTARIES, rt. angle, pc mt, on-on (#5635) ... 1.29 — 10 for 1.30
- 25-TTL's, with 7400's, u test, dips (#2415A) ... 1.29 — 50 for 1.30
- 30-RADIO AND TV KNOBS, asst styles, sizes (#217) ... 1.29 — 60 for 1.30
- 60-TUBULAR CAPACITORS, asst. volts and sizes (#219) ... 1.29 — 120 for 1.30
- 55-LOW NOISE RESISTORS, ¼, ½W, HIFI, etc (#220) ... 1.29 — 110 for 1.30
- 50-POWER RESISTORS, 3,5,7 w. axial, pop sizes (#228) ... 1.29 — 100 for 1.30
- $25 SURPRISE, all kinds of parts in a pak (#294) ... 1.29 — 2 for 1.30
- 12-PANEL SWITCHES, rotary, slide, toggle etc (#295) ... 1.29 — 24 for 1.30
- 60-COILS AND CHOKES, rf, parasitic, lil, etc (#297) ... 1.29 — 120 for 1.30
- 60-TERMINAL STRIPS, up to 4 solder lugs (#334) ... 1.29 — 120 for 1.30
- 60-PRECISION RESISTORS, ½W, 1%, axial (#363) ... 1.29 — 120 for 1.30
- 50-MICA CAPACITORS, asst values (#373) ... 1.29 — 100 for 1.30
- 10-SETS RCA PLUGS AND JACKS, phono (#402) ... 1.29 — 20 for 1.30
- 60-DISC CAPACITORS, asst values long leads (#437) ... 1.29 — 120 for 1.30
- 20-TRANSISTOR ELECTRO'S, asst up and ax (#453) ... 1.29 — 40 for 1.30
- 75-HALF WATTERS, resistors, color coded, asst (#454) ... 1.29 — 150 for 1.30
- 35-SILVER MICAS, red backs, axial, asst (#455) ... 1.29 — 70 for 1.30
- 4-PUSH BUTTON, SPST, PANEL, N.C. 125V, @ 1A (#5389) ... 1.29 — 8 for 1.30
- 100-GERMANIUM DIODES, axial leads, u test (#642) ... 1.29 — 200 for 1.30
- 100-STABISTORS, Regulator, sensing and computer. Axial, ez. yield (#3140) ... 1.29 — 200 for 1.30
- 100-PRINTED CIRCUIT ½ WATT RESISTORS, asst (#1060) ... 1.29 — 200 for 1.30
- 12-TRANSISTOR SOCKETS, asst open and pop types (#651) ... 1.29 — 24 for 1.30
- 50-3 AMP SILICON RECTIFIERS, axial, asst V (#865) ... 1.29 — 100 for 1.30
- 50-POLYSTYRENE CAPS, plastic coated, prec. (#1052) ... 1.29 — 100 for 1.30
- 30-4" CABLE TIES, non-slip white plastic (#5217) ... 1.29 — 60 for 1.30
- 30-pc-HEAT SHRINK, asst sizes, 50% shrinkage (#5248) ... 1.29 — 60 for 1.30
- 2-5.1V, 5%, 10W, STUD ZENER, DO-4 case (#5287) ... 1.29 — 4 for 1.30
- 10-RCA PHONO JACKS, chassis mount, teflon base (#5119) ... 1.29 — 20 for 1.30
- 15-THERMISTORS, asst types, styles & values (#2048) ... 1.29 — 30 for 1.30
- 4-5-DIGET 7-SEGMENT READOUTS, in flat pak case (#5616) ... 1.29 — 8 for 1.30
- 4-¼" BLOCK TRIM POTS, 5K (#2536) ... 1.29 — 8 for 1.30
- 1-"FOTO-FET" N CHANNEL, Crystalonics. J-Sealed Effect Transistors (#1169) ... 1.29 — 2 for 1.30
- 1-VOLTAGE REGULATOR, TO202 case, 12V 600MA (#1900) ... 1.29 — 2 for 1.30
- 2-3 DIGITS ON A DIP, LED, red, DL-33 (#1887) ... 1.29 — 4 for 1.30
- 3-MM5262 2K DYNAMIC RAM, specify type (#3459) ... 1.29 — 6 for 1.30
- 10-2N711 HIGH SPEED SWITCHING TRANSISTORS, TO18, npn (#3374) ... 1.29 — 20 for 1.30
- 2-15W HI POWER TRANSISTORS, 220V, npn, TO66 (#2797) ... 1.29 — 4 for 1.30
- 15-NE-2 bulbs for 110vac projects, hobby, etc. less resistor (#1433) ... 1.29 — 30 for 1.30
- 1-MM5312 DIGITAL CLOCK CHIP, 100% (#1525) ... 1.29 — 2 for 1.30
- 2-MM5725 4 FUNCTION CALCULATOR CHIP, 100% (#2036) ... 1.29 — 4 for 1.30
- 1-MM5262 ERASABLE PROM, 100% (#3459) ... 1.29 — 2 for 1.30
- 3-10 AMP 25V BRIDGE RECT, comb style (#2447) ... 1.29 — 6 for 1.30
- 1-ALLEN BRADLEY POT, 10K, 2-14 watts, type-J, 2½" shaft (#1748) ... 1.29 — 2 for 1.30
- 6-LINEAR SWITCHING TRANSISTORS, 2N2905, pnp, TO5 (#3375) ... 1.29 — 12 for 1.30
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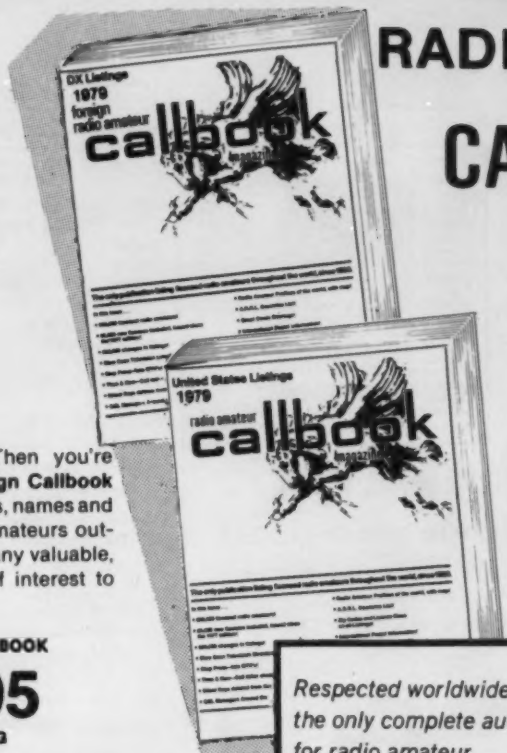

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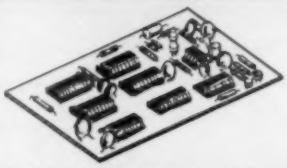

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2N2222M	(2N2222 Plastic .10)	.15
2N2222A		.19
2N2907A	PNP	.19
2N3906	PNP (Plastic)	.19
2N3904	NPN (Plastic)	.19
2N3054	NPN	.55
2N3055	NPN 15A 60v	.60
T1P125	PNP Derlington	1.95
LED Green,	Red, Clear, Yellow	.19
D.L.747	7 seg 5/8" High com-anode	1.95
MAN72	7 seg com-anode (Red)	1.25
MAN3610	7 seg com-anode (Orange)	1.25
MAN82A	7 seg com-anode (Yellow)	1.25
MAN74	7 seg com-cathode (Red)	1.50
FND359	7 seg com-cathode (Red)	1.25

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QTY.		QTY.	
9301	.85	9322	.65
9309	.50	9601	.30
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8T13	2.50
8T23	2.50
8T24	3.00
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1489	1.25
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8228	6.00
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8253	18.50
8255	8.50
TMS 4044	9.95

C MOS

QTY.		QTY.		QTY.		QTY.	
4000	.15	4017	.75	4034	2.45	4069/74C04	.45
4001	.20	4018	.75	4035	.75	4071	.25
4002	.25	4019	.35	4037	1.80	4081	.30
4004	3.95	4020	.85	4040	.75	4082	.30
4006	.95	4021	.75	4041	.69	4507	.95
4007	.25	4022	.75	4042	.65	4511	.95
4008	.75	4023	.25	4043	.50	4512	1.50
4009	.35	4024	.75	4044	.65	4515	2.95
4010	.35	4025	.25	4046	1.25	4519	.85
4011	.30	4026	1.95	4047	2.50	4522	1.10
4012	.25	4027	.35	4048	1.25	4526	.95
4013	.40	4028	.75	4049	.65	4528	1.10
4014	.75	4029	1.15	4050	.45	4529	.95
4015	.75	4030	.30	4052	.75	MC14409	14.50
4016	.35	4033	1.50	4053	.95	MC14419	4.85
				4066	.75	74C151	2.50

– TTL –

4-1-79

QTY.		QTY.		QTY.		QTY.	
7400	.20	7492	.45	74H20	.25	74LS76	.70
7401	.20	7493	.35	74H21	.25	74LS86	.95
7402	.20	7494	.75	74H22	.40	74LS90	.85
7403	.20	7495	.60	74H30	.30	74LS93	.85
7404	.20	7496	.60	74H40	.35	74LS96	2.00
7405	.35	74100	1.15	74H50	.30	74LS107	.90
7406	.25	74107	.35	74H51	.30	74LS109	1.50
7407	.55	74121	.35	74H52	.20	74LS123	1.95
7408	.20	74122	.55	74H53	.25	74LS138	2.00
7409	.25	74123	.55	74H55	.25	74LS151	.95
7410	.20	74125	.45	74H72	.35	74LS153	1.15
7411	.25	74126	.45	74H74	.35	74LS157	1.15
7412	.25	74132	.75	74H101	.95	74LS160	1.15
7413	.45	74141	.90	74H103	.55	74LS164	2.90
7414	.75	74150	.85	74H106	1.15	74LS193	2.00
7416	.25	74151	.95	74L00	.30	74LS195	1.15
7417	.40	74153	.95	74L02	.30	74LS244	2.90
7420	.25	74154	1.15	74L03	.35	74LS259	1.50
7426	.25	74156	.70	74L04	.40	74LS298	1.50
7427	.25	74157	.65	74L10	.30	74LS367	1.95
7430	.20	74161/9316	.75	74L20	.45	74LS368	1.25
7432	.30	74163	.85	74L30	.55	74LS373	2.50
7437	.20	74164	.75	74L47	1.95	74S00	.45
7438	.30	74165	1.10	74L51	.65	74S02	.45
7440	.20	74166	1.75	74L55	.85	74S03	.35
7441	1.15	74175	.90	74L72	.65	74S04	.35
7442	.55	74176	.95	74L73	.70	74S05	.45
7443	.45	74177	1.10	74L74	.75	74S08	.45
7444	.45	74180	.95	74L75	1.05	74S10	.45
7445	.75	74181	2.25	74L85	2.00	74S11	.45
7446	.70	74182	.75	74L93	.75	74S20	.35
7447	.70	74190	1.25	74L123	1.95	74S22	.55
7448	.50	74191	1.25	74LS00	.40	74S40	.30
7450	.25	74192	.75	74LS01	.40	74S50	.30
7451	.25	74193	.85	74LS02	.45	74S51	.35
7453	.20	74194	.95	74LS03	.45	74S64	.15
7454	.25	74195	.95	74LS04	.45	74S74	.70
7460	.40	74196	.95	74LS05	.45	74S112	.60
7470	.45	74197	.95	74LS08	.45	74S114	.85
7472	.40	74198	1.45	74LS09	.45	74S133	.85
7473	.25	74221	1.50	74LS10	.45	74S140	.75
7474	.30	74298	1.50	74LS11	.45	74S151	.85
7475	.35	74367	1.35	74LS20	.45	74S153	.95
7476	.40	75491	.65	74LS21	.45	74S157	.98
7480	.75	75492	.65	74LS22	.45	74S158	.80
7481	.85	74H00	.20	74LS32	.50	74S194	1.50
7482	.95	74H01	.30	74LS37	.45	74S196	2.00
7483	.95	74H04	.30	74LS38	.65	74S257 (8123)	2.50
7485	.75	74H05	.25	74LS40	.70	8131	2.75
7486	.55	74H08	.35	74LS42	.95		
7489	1.05	74H10	.25	74LS51	.75		
7490	.55	74H11	.25	74LS74	.95		
7491	.70	74H15	.45	74LS75	1.20		

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LM301	.45	LM320T15	1.65	78L12	.75
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LM309 (340K-5)	1.50	LM339	.75	LM380 (8-14 Pin)	1.19
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LM320H15	.79	LM340T24	.95	LM739	1.50
LM320H24	.79	LM340K12	1.25	LM741 (8-14)	.45
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LM320K12	1.65	LM340K18	1.25	LM1307	1.75
LM320K15	1.65	LM340K24	1.25	LM1458	.65
				LM3900	.95
				LM75451	.65
				NE555	.45
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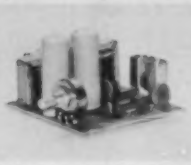

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1N746 to	4/$1	2N1889	.39	2N4240	5/$1	E101	3/$1	LM3750*	.55
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SPACER Kit	4 ea of 5 assorted size spacers	$1.00
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1N270	Germanium Diode 80V 200mA	4/$1
1N823	Temp Comp Reference 6.2V±5% ± .005%/° C	$0.60
1N914	Silicon Diode 100V 10mA	25/$1
1N3044	100V Zener 1W–Better than an OB3	.75
1N3045	110V Zener 1W–Better than an OB2/OC3	.75
1N3071	200V 100mA Switching Diode 40ns	.30
2N2915	NPN Dual Transistor 3mV Match β100	$1.95
2N3819M	N-Channel RF FET 100MHz Amp	.35
2N4020	PNP Dual Transistor 5mV Match β250	5.00
2N4445	N-Channel FET 5Ω Switch	3.50
2N5394E	Ultra-Low Noise J-FET Audio Amp	$1.25
2N5912	Dual J-FET RF Dif Amp to 800MHz	2.90
2N6028	Programmable Unijunction Transistor	.45
2N6449	300 Volt N-Channel J-FET Amp/Sw	2.00
CP640	Broadband FET RF Amp 140dB Dyn Range	$4.50
E304	N-Channel RF FET 3.8dB NF @ 400MHz	.50
MPSA12	NPN Darlington Transistor β20,000	.75
TIS88	N-Channel FET 400MHz RF Amp	.60
RESISTOR Kit	150 pcs ¼W, 20 most common values, individually packaged, 5 to 20 pcs each.	$4.95
PC BOARD Mounting Kit	8 ea spacer, screw, nut and washer–32 pcs total.	$1.00

SEND FOR ADVA'S NEW 1979 CATALOG
NEARLY 1000 SEMICONDUCTORS, KITS, CAPACITORS, ETC.-SEND 25¢ STAMP.

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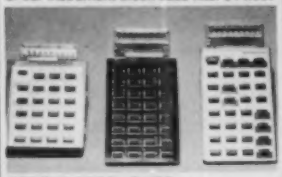
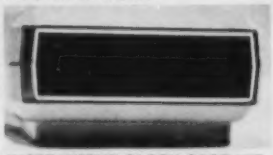
MOTOROLA 4 MHZ XTAL OSCILLATOR 14 pin dip pkg., 5 VDC in, 4 MHz out. TTL compatible. **$5.95 ea.**

NATIONAL SEMICONDUCTOR - 6 DIGIT CLOCK MODULE A 12-hr. clock featuring alarm and snooze alarm function. Comes complete with everything. All you add is a power cord and switches. Each module utilizes discreet components and is ready for you to mount in your enclosure. Display is 6 each seven segments, .33 inches high, clockchip is MM5375. Can easily be mounted in either of our instrument clock case kits. **$14.95.**



CALCULATOR GUTS
Experimenter's delight. Each keyboard includes a monolithic calculator chip and display. These are rejects. It might be something simple to repair or it could be very nasty. At this price, who cares! 9 volt. **$1.50 ea. 3/$3.00.**

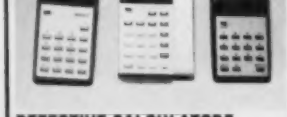


INSTRUMENT CLOCK CASE KIT
A real jewel for those small projects. Hinged top door allows you to hide your control area. O.D. 4½" x 4" x 1¾". **$1.99 each.**

DB-25 FEMALE CONNECTOR
A unique assembly originally adapting the RS232 Type Connector to flat cable. **$1.50 each or 2/$2.50.**

INSTRUMENT/CLOCK CASE KIT
Perfect for your opto projects. Solid aluminum construction with real walnut sides. O.D. 5-3/8" by 5-3/8" by 2". **$6.95 ea.**

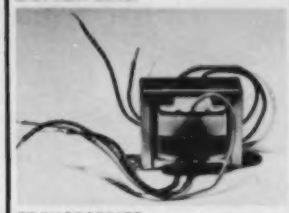
EDGE CARD CONNECTOR
Cinch Jones 10/20 Pins. .156 Spacing PC Mount. .85 Burndy 22/44 Pins, .156 spacing PC Mount, **$1.40 each.**



DEFECTIVE CALCULATORS
Well, some are and some are not. We can't afford the time to test them. **$2.50 ea.** Batteries not included. **2/$4.00.**

LINE PRINTER HAMMER DRIVER BOARD Each board contains approx. 130 each #MJE800 (Silicon Darlington NPN hfe 750, 1.5A). About $130.00 worth, over 100 1N4001 diodes, plus support chips. The whole package is yours for only **$14.95.**

HURRY, WE DON'T EXPECT THESE TO LAST VERY LONG!



TRANSFORMER Pri. 110 VAC Sec. 11.2 and 5 VCT @ .1 amp. **$.95 ea.**

MINIATURE D.P.D.T. [PUSH BUTTON] momentary, rated 6A/125 VAC, microswitch part #8N2021. **Only $1.54.**

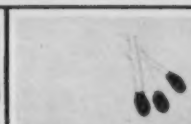
CLOCK DISPLAY
National Semi. 6 Digit Multiplexed Display; .33" Characters (Common Cathode). **A REAL BUY AT JUST $1.00.**

EDGE METER 100-0-100 ua 1/2" by 11/16". Compare with other meters costing $6.00. **Only $2.00 ea.** Why pay more?

DIODE SALE 1N4148
100/$1.95 TAPE/REEL
1000/$14.95

DIODES

TYPE	VOLTS	WATTS	PRICE
1N4001	50	1A	15/$1.00
1N4002	100	1A	15/$1.00
1N4003	200	1A	12/$1.00
1N4004	400	1A	12/$1.00
1N4005	600	1A	10/$1.00
1N4006	800	1A	10/$1.00
1N4007	1000	1A	6/$1.00
1N5400	50	3A	5/$1.00
1N5401	100	3A	5/$1.00
1N5402	200	3A	5/$1.25
1N5403	300	3A	4/$1.25
1N5404	400	3A	4/$1.25
1N5405	500	3A	4/$1.49
1N5406	600	3A	4/$1.49
1N5407	800	3A	3/$1.49
1N5408	1000	3A	2/$ .99
1N4148	75	10M	20/$1.00



SOLID DIPPED TANTALUM CAPACITORS

		1-99	100 PLUS
.1 X	35 VOLT	.23	.19
.15	35	.23	.19
.22	35	.23	.19
.33	35	.23	.19
.47	35	.23	.19
.68	35	.23	.19
1.0	35	.25	.20
1.5	35	.29	.23
2.2	35	.31	.25
3.3	35	.36	.29
4.7	35	.38	.30
6.8	35	.50	.40
10.0	35	.60	.48
15.0	35	.79	.63
22.0	35	1.39	1.12
33.0	35	2.08	1.66
47.0	35	2.65	2.12

VALUES AND QUANT. MAY BE ASSORTED TO ATTAIN QUANT. PRICING

NYLON TIE WRAPS

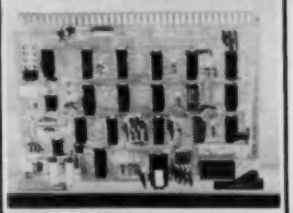
3"	65000	10/$ .30
4"	65002	10/ .50
5.3"	65003	10/ .59
6.9"	65004	10/ .69
10.8"	65005	10/ 1.59
13.0"	65006	10/ 2.69
14.4"	65055	10/ 2.96
SCREW MOUNT		
13.6"	65054	10/ 4.29
7.4"	65052	10/ .98
5.8"	65051	10/ .89
4.4"	65050	10/ .75

GALLIUM PHOSPHIDE L.E.D.'s
Provide greater light out-put, brighter colors, greater uniformity and less current drain than regular L.E.D.'s

.110 DIAMETER			
P/N 724H	Red Diffused	4/$1.00	
724G	Green Diffused	4/ 1.19	
724Y	Yellow Diffused	4/ 1.49	
7240	Orange Diffused	4/ 1.49	
.220 DIAMETER			
714H	Red Diffused	5/$1.19	
714G	Green Diffused	4/ 1.49	
714Y	Yellow Diffused	4/ 1.59	
7140	Orange Diffused	4/ 1.59	
.220 DIAMETER (low dome)			
704R	Red Diffused	4/$1.59	
704G	Green Diffused	4/ 1.65	
704Y	Yellow Diffused	4/ 1.84	
7040	Orange Diffused	4/ 1.84	
101R-g	Dual (Red and Green)	$2.85	2/5.00
MOUNTING HARDWARE			
.220 Diameter #7aMH			12/$1.44

¼ WATT 5% DEPOSITED CARBON FILM RESISTOR ASSORTMENTS

ASST. A	10 ea 1 OHM 1.5 OHM 2 OHM 2.7 OHM 3 OHM 3.6 OHM 4.7 OHM 5.6 OHM 6.8 OHM 8.2 OHM	100 pcs $2.40
ASST. B	10 ea 10 OHM 12 OHM 15 OHM 18 OHM 22 OHM 27 OHM 33 OHM 39 OHM 47 OHM 56 OHM	100 pcs $2.40
ASST. C	10 ea 68 OHM 82 OHM 100 OHM 120 OHM 150 OHM 180 OHM 220 OHM 270 OHM 330 OHM 390 OHM	100 pcs $2.40
ASST. D	10 ea 470 OHM 560 OHM 680 OHM 820 OHM 1K 1.2K 1.5K 1.8K 2.2K 2.7K	100 pcs $2.40
ASST. E	10 ea 3.3K 3.9K 4.7K 5.6K 6.8K 8.2K 10K 12K 15K 18K	100 pcs $2.40
ASST. F	10 ea 22K 27K 33K 39K 47K 56K 68K 82K 100K 120K	100 pcs $2.40
ASST. G	10 ea 150K 180K 220K 270K 330K 390K 470K 560K 680K 820K	100 pcs $2.40
ASST. H	10 ea 1M 1.2M 1.5M 1.8M 2.2M 2.7M 3.3M 3.9M 4.7M 5.6M	100 pcs $2.40
ASST. A-H	INCLUDES ALL RESISTOR ASSORTMENTS (800 pcs)	$14.95 ea



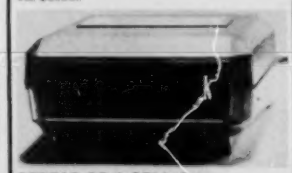
PARTS BOARDS A great way to buy parts on a budget. We guarantee your money's worth. **ONLY $1.00 ea.**

ROTRON WHISPER FAN #WR2H1
3 Blade 4" Diameter 75CFM 115VAC. NET $17.00 **YOUR PRICE $9.95** Wait now, these are not pull-outs or something like that, these are new!

CLAIREX PHOTO CELLS
These have a real USEFUL range to them. Any project involving control from ambient light levels will utilize this photo cell. Light resistance 1K. Fast response. .156 Diameter. **$.75 each or 2/$1.00.**

NOVUS CALCULATOR #824R
Rechargeable Ni-Cad calculator WITH MEMORY, EX, CS AND % KEY. **$4.95 ea.** (owners manual and charger are not included)

PLASTIC PARTS BOX A nice little hinged-top box for storing all your small parts. O.d. 6¾" by 3¾" by 2". **$.75 ea. 10/$5.00.**



REPEAT OF A SELL-OUT A complete 12 hour digital clock. Some are manufacture line rejects, some are returns, and some are just scratched. Features: hours, minutes, alarm, snooze alarm. Parts value alone would equal $20.00, you pay **only $6.00 ea.**

HOT DEALS

75493N (quad seg. driver)	.55
SN7428N	.25
1000uf 25VDC P-C	.25
2000uf 25VDC AXIAL	.50
18 ga. LINE CORD 6'	.25
2N2222A	4/1.00
2N3054	.75
2N3055 (TO-3)	.99
MEMOREX 1" VIDEO TAPE ½ HOUR (with case)	4.95
SIEMENS MAGNETIC SENSOR	1.99
43/43 GOLD EDGE CONN. .156	4.95
P/B MIN. 12VDC RELAY D.P.D.T.	1.99

FREE BY POPULAR DEMAND
With min. purchase of **$50.00**, you will receive free, a 5 function National Semiconductor L.C.D. mens watch. With min. purchase of **$100.00** you will receive free, our L.C.D. car clock. (watch and clock advertised in Dec. issue of 73 Mag.)

For Master Charge/Visa Orders Use Our TOLL FREE HOT LINE: 1-800-426-0634 for areas outside Washington (incl. Alaska & Hawaii)

O.E.M.'s WELCOME

Terms: All orders shipped promptly. Minimum order $5.00. Telephone orders accepted. All orders shipped UPS or PP. Add 5% extra for shipping & handling. Washington state residents add additional 5.4% sales tax. Master Charge & Visa cards accepted. Money orders & your personal or company check are welcome. Funds made payable in U.S. currency only. No C.O.D. orders. Your satisfaction is guaranteed on all merchandise purchased. All merchandise subject to prior sale. Open account to govt. agencies & publicly funded schools.

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Reader Service—see page 195

Social Events

from page 168

John Juul-Andersen VE7DTX, 8802 Lakeview Dr., Vernon, B.C., Canada V1B 1W3, or Lota Harvey VE7DKL, 584 Heather Rd., Penticton, B.C., Canada V2A 1W8.

BOWLING GREEN OH
JUL 29

The Wood County Amateur Radio Club will hold its 15th annual Wood County Ham-a-Rama on July 29, 1979, at the Bowling Green Fairgrounds, Bowling Green, Ohio. Gates will open at 10:00 am, with free admission and parking. Dealer tables and space are available. Trunk sale space and food will also be available. Tickets are $1.50 in advance and $2.00 at the door. Prizes will be awarded. Talk-in on .52 K8TIH. For information, write Wood County ARC, c/o Eric Willman, 14118 Bishop Road, Bowling Green OH 43402.

FLAGSTAFF AZ
AUG 3-5

The Amateur Radio Council of Arizona will hold its annual Ft. Tuthill Hamfest on August 3-5, 1979, at Flagstaff, Arizona. Prizes include TS-520 transceivers, a microwave oven, a Wilson Mark II HT, a Wilson System III triband antenna, and more. Featured will be a western barbecue, tech sessions, and exhibits. Camping facilities are also available. For further details or information, write Ft. Tuthill Hamfest, c/o 8520 E. Edwards Ave., Scottsdale AZ 85253.

LITTLE ROCK AR
AUG 4-5

The Central Arkansas Radio Emergency Net (CAREN) Amateur Radio Club will hold its second annual Ham-a-Rama on Saturday and Sunday, August 4-5, 1979, at the Arkansas State Fairgrounds, Little Rock, Arkansas. There will be two main prizes given, as well as door prizes. Featured will be forums, dealers' exhibits, a Saturday night party, and a large flea market. Talk-in on 146.34/.94. For details, send an SASE to Morris Middleton AD5M, 19 Elmherst Drive, Little Rock AR 72209.

JACKSONVILLE FL
AUG 4-5

The Jacksonville Hamfest Association is pleased to announce the 1979 Jacksonville Hamfest and ARRL North Florida Section Convention to be held on August 4-5, 1979, at the Jacksonville Beach Municipal Auditorium, Jacksonville, Florida. The location is just one block from the beach, where U.S. 90 meets the sea.

Advanced registrations are available at $3.00 per person from R. J. Cutting W2KGI/4, 303 10th St., Atlantic Beach, Florida 32233. Price at the door will be $3.50.

A large indoor swap area will be featured, with advance table reservations available for $5.00 per table per day from Robbie Roberts KH6FMD/W4, 10557 Atlantic Blvd., #31, Jacksonville, Florida 32211. Information on exhibitors' booths and space are available from the same address.

Other features and programs include statewide organization meetings on such topics as traffic nets and MARS, a microprocessor seminar, a solar power demonstration, a DX "pileup" contest, a hidden transmitter hunt, an OSCAR forum, ARRL forums, emergency preparedness programs, DX and contest presentations, antenna and technical seminars, and much more.

More general information may be obtained from JHA, 911 Rio St. Johns Dr., Jacksonville FL 32211.

MT SINAI LI NY
AUG 5

The Radio Central Amateur Radio Club will hold its "Ham-Central" on Sunday, August 5, 1979 (rain date is August 12, 1979), at the Mt. Sinai Elementary School, Rte. 25A, Mt. Sinai, Long Island, New York. Admission for sellers is $3.00 per tailgate space and $1.50 for buyers, with XYL and children under 12 free. Monies are to be used for Radio Central and the St. Charles Hospital Repeater. Doors will open at 7:00 am for sellers and 9:00 for others. They will close at 4:00 pm. Featured will be antenna advice with Art and Madeline Greenberg, a Novice table, great food, a CW contest, an ARRL table, a special event of a fly-in by the Suffolk County Police Dept. helicopter, and a Radio Central Club table. Talk-in on 146.52 WA2UEC and 144.71/145.31 K2VL. For information, call Joan Longtin at (516)-924-8438 or Robin Goodman at (516)-744-6260, or write Radio Central, "Ham-Central," PO Box 680, Miller Place NY 11764.

SALEM OH
AUG 5

The second annual Salem Area Hamfest will be held on August 5, 1979, from 9:00 am to 3:00 pm at the Kent State Salem campus, Salem, Ohio. Tickets are $1.50 in advance and $2.00 at the door. Inside tables are $5.00 with space for your own table at $2.00. Flea market space is $1.00. There will be air-conditioning, a wheelchair ramp, free parking, refreshments, and prizes, consisting of an Atlas RX-110, TX-110, and a PS-110. Talk-in on 146.52. For details, write Harry Milhoan WA8FBS, 1128 West State, Salem OH 44460.

LEVELLAND TX
AUG 5

The Hockley County Amateur Radio Club and the Northwest Texas Emergency Net will sponsor their 14th annual picnic and swapfest on Sunday, August 5, 1979, at the City Park, Levelland, Texas. A $2.00 registration is requested but not required. Registration begins at 8:00 am and lunch will begin at 12:30 pm with a bring-your-own-picnic-basket lunch. There will be swapping all day with tables provided. Talk-in on 146.28/.88.

GLENN MI
AUG 5

The Black River Amateur Radio Club will sponsor its 26th annual VHF Picnic and Swap 'n Shop on Sunday, August 5, 1979, at the Allegan County Park, Glenn, Michigan. Take Interstate 196 north of South Haven, Michigan, to the Glenn Exit. Door prizes will be awarded. Bring the family and a picnic basket (no lunch will be provided on the grounds) to enjoy the beach and playground. Talk-in on 147.90/.30 and 146.52. For information, contact Ed Alderman WB8BNN, RR#2, Box 98AA, Bangor MI 49013, or phone (616)-427-8830.

ANGOLA IN
AUG 5

The Steuben County Radio Amateurs will hold their annual F.M. Picnic and Hamfest on Sunday, August 5, 1979, at Crooked Lake, Angola, Indiana. There will be prizes, picnic-style barbecued chicken, inside tables for exhibitors and vendors, and overnight camping (fee charged by county park). Talk-in on 146.52 and 147.81/.21. Admission is $2.00.

MUNCIE IN
AUG 11

The Delaware Amateur Radio Association will hold its 2nd annual hamfest on Saturday, August 11, 1979, starting at 7:00 am, at Springwater Park, County Roads 300 E. and 100 N., Muncie, Indiana. Tickets are $1.50 in advance and $2.00 at the gate. Reserved table space is $1.00 per table with no extra charge for outside space. There will be hourly drawings from 9:00 am until 3:00 pm, with the grand prize of a Tempo SYNCOM S1 being drawn at 3:00 pm. Second prize will be a HAM III rotor. Talk-in on 146.25/.85 and 146.52/.52. For information or tickets, send money and an SASE to DARA, PO Box 3021, Muncie IN 47302.

LEXINGTON KY
AUG 12

The Bluegrass Amateur Radio Club will hold its annual Central Kentucky Hamfest on August 12, 1979, at the Fasig-Tipton Sales Paddock, Newton Pike, Lexington, Kentucky. The program will include grand prizes, hourly door prizes, manufacturers' exhibits, an indoor/outdoor flea market, guest speakers, and forums. For information, contact the Bluegrass Amateur Radio Club, Inc., PO Box 4411, Lexington KY 40504.

PETOSKEY MI
AUG 18-19

The Straits Area Radio Club will hold its Swap 'n Shop and hamfest on August 18-19, 1979, at Petoskey Middle School, State and Howard Streets, across from the Catholic church and post office, Petoskey, Michigan. There will be a donation of $2.00 at the door. Table space is also $2.00. Refreshments will be available. There will be a swap and shop on Saturday from 9:00 am to 4:00 pm and on Sunday from 9:00 am to 12:00 pm. Prizes, a ladies' program, and seminars at 11:00 am and 2:00 pm on Saturday will be featured. A banquet at the Holiday Inn on Saturday at 7:00 pm will have Mellish Reef DXpeditioner Bob Walsh WA8MOA as guest speaker. Banquet tickets are $7.50 and are limited to 200, sold in advance only. For full information and lodging, send an SASE to Bill Moss WA8AXF, 715 Harvey Street, Petoskey MI 49770, or phone (616)-347-4734.

ST. CHARLES IL
AUG 26

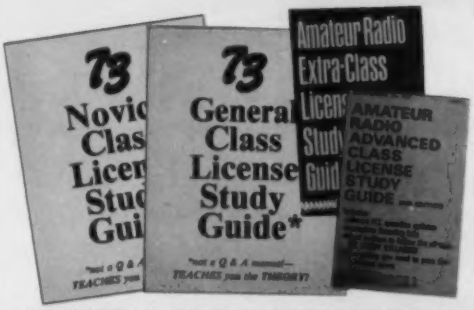
The Fox River Radio League will hold its hamfest on Sunday, August 26, 1979, at the Kane Co. Fairgrounds Exhibition Hall, St. Charles, Illinois. Tickets are $1.50 in advance and $2.00 at the gate. For information, contact Martin Schwamberger WB9TNQ, 1051 Northfield Drive, Aurora IL 60505.

BEREA OH
SEP 23

The fourth annual Cleveland Hamfest will be held on Sunday, September 23, 1979, at the Cuyahoga County Fairgrounds, Berea, Ohio. The hamfest will be an all-indoor operation. There will be 10-foot booths available with an 8-foot table and two chairs for $30.00.

Radio Bookshop

License Study Guides & Tapes



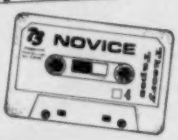
● **NOVICE STUDY GUIDE**—SG7357—Here is a completely new study guide and reference book for the potential ham. This is not a question/answer memorization course. Electronic and radio fundamentals are presented and explained in an easy-to-understand fashion, preparing the beginner for the Novice exam. Includes the latest FCC amateur regulations, as well as application forms. Easily the best path into the exciting world of ham radio! $4.95.*

● **GENERAL CLASS STUDY GUIDE**—SG7358—A complete theory course for the prospective General or Technician. This reference explains transistor, amplifier, and general radio theory, while preparing the Novice for the "big" ticket. After getting your ticket, you'll use this guide again and again as an electronic reference source. Not a question/answer guide that becomes dated when the FCC updates the amateur exams. $5.95.*

● **ADVANCED CLASS STUDY GUIDE**—SG1081—Ready to upgrade your license? To prevent retaking the FCC theory exam, you need the *73* Advanced theory guide. SSB, antenna theory, transmitters, and electronics measuring techniques are covered in detail in this easy-to-follow study guide. Special modes and techniques, such as RTTY, are also treated. An engineering degree is *not* necessary to master Advanced theory—try this book before visiting the examiner's office! $5.95.*

● **EXTRA CLASS LICENSE STUDY GUIDE**—SG1080—Before going for your 1 × 2 call, it pays to be a master of the Extra class electronic theory. This study guide is the logical extension of the *73* theory course. All the theory necessary to pass the exam is presented. Antennas, transmission lines, swr are discussed, as well as noise, propagation, and specialized communication techniques. This book is not a classroom lecture or memorization guide, but rather a logical presentation of the material that must be *understood* before attempting the Extra exam. Save yourself a return trip to the FCC and try the *73* method first! $5.95.*

NOVICE THEORY TAPES
Startling Learning Breakthrough



● **NOVICE THEORY TAPES**—CT7300—Startling Learning Breakthrough. You'll be astounded at how really simple the theory is when you hear it explained on these tapes. Three tapes of theory and one of questions and answers from the latest Novice exams give you the edge you need to breeze through your exam. *73* is interested in helping get more amateurs, so we're giving you the complete set of our tapes for the incredibly low price of **ONLY $15.95.***

Scientists have proven that you learn faster by listening than by reading because you can play a cassette tape over and over in your spare time—even while you're driving! You get more and more info each time you hear it.

You can't progress without solid fundamentals. These four hour-long tapes give you all the basics you'll need to pass the Novice exam easily. You'll have an understanding of the basics which will be invaluable to you for the rest of your life! Can you afford to take your Novice exam without first listening to these tapes? Set of 4—$15.95.*

SSTV

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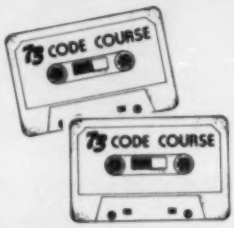

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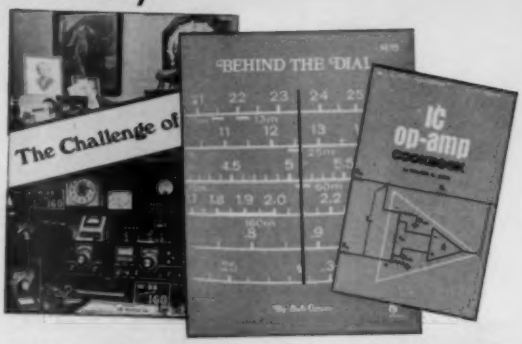

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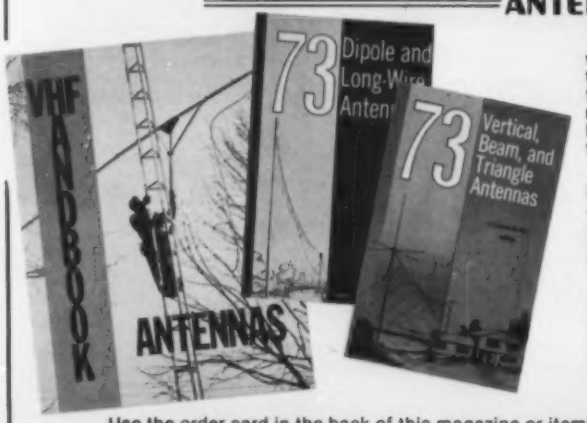

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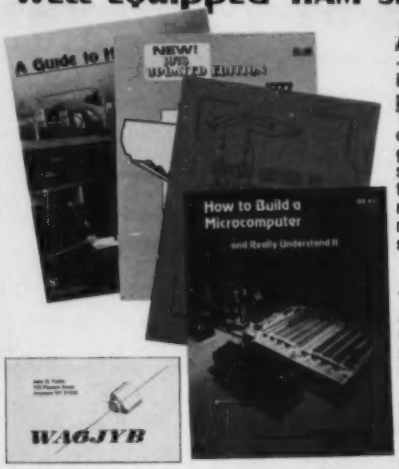

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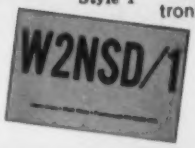

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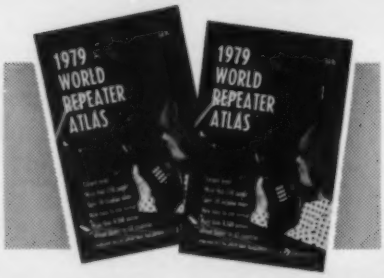

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ALASKA	14	14	14	7	7	7	7	7A	14	14	14	14
ARGENTINA	21	21	14	14	7	7	14	21	21	21A	21A	21A
AUSTRALIA	21	21	14	7A	7	7	7	7	7	7	14	14
CANAL ZONE	21	14A	14	14	7	7	7A	14	14	21	21A	21A
ENGLAND	14	14	7A	7	7	7A	14	14A	14A	14A	14	14
HAWAII	21	21	14	14	7	7	7A	14	14	14	14A	21
INDIA	14	14	14	7B	7B	7B	14	14	14	14	14	14
JAPAN	14A	14	14	7A	7	7	7	14	14	14	14	14A
MEXICO	21	21	14	7A	7	7	7	14	14	14	21	21
PHILIPPINES	14	14	14	14	7B	7B	7B	14	14	14	14	14
PUERTO RICO	14	14	7A	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7B	7B	7	7	7B	14	21	21	21A	21	14	14B
U. S. S. R.	14	14	7A	7	7	7A	14	14	14	14	14	14
WEST COAST	14A	14	14	14	7	7	7A	14	14	14	14A	14A

CENTRAL UNITED STATES TO:												
ALASKA	14	14	14	14	7	7	7	7	14	14	14	14
ARGENTINA	21A	21	14	14	7	7	14	14	21	21	21A	21A
AUSTRALIA	21	21A	21	14	7A	7	7	7	7	7	14	21
CANAL ZONE	21	21	14	7A	7	7	7A	14	14	21	21A	21A
ENGLAND	14	14	7A	7	7	7	7	14	14A	14A	14A	14
HAWAII	21	21A	21	14	7	7	7	7A	14	14	14	14A
INDIA	14	14	14	14B	7B	7B	7B	14	14	14	14	14
JAPAN	14A	14A	14	14	7	7	7	14	14	14	14	14
MEXICO	14	14	7	7	7	7	7	7A	14	14	14	14
PHILIPPINES	14	14	14	14	7B	7B	7B	14	14	14	14	14
PUERTO RICO	21	14	14	7	7	7	14	14	14	14	21	21
SOUTH AFRICA	7B	7B	7	7	7B	7B	14	14	21	21	14	14B
U. S. S. R.	14	14	7A	7	7	7	7A	14	14	14	14	14

WESTERN UNITED STATES TO:												
ALASKA	14	14	14	14	7	7	7	7	14	14	14	14
ARGENTINA	21A	21	14A	14	7	7	7A	14	21	21	21A	21A
AUSTRALIA	21A	21A	21	21	14	14	7	7	7	7	14	21
CANAL ZONE	21A	21	14	14	7	7	7	14	14	14	21	21A
ENGLAND	14	14	7A	7	7	7	7	14	14A	14A	14	14
HAWAII	21	21A	21A	21	14	14	7	7	14	21	21	21
INDIA	14	14	14	14B	7B	7B	7B	14	14	14	14	14
JAPAN	14A	14A	21	14	14	14	7	7	14	14	14	14
MEXICO	21	21	14	7A	7	7	7	14	14	14	14	21
PHILIPPINES	14	14A	14A	14	14	7B	7B	14	14	14	14	14
PUERTO RICO	21	14A	14	14	7	7	7	14	14	14	21	21
SOUTH AFRICA	7B	7B	7	7	7B	7B	7B	14	14	14	14	14B
U. S. S. R.	14	7A	7	7	7	7	7A	14	14	14	14	14
EAST COAST	14A	14	14	14	7	7	7A	14	14	14	14A	14A

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

june

sun	mon	tue	wed	thu	fri	sat
					1 G	2 G
3 G	4 F	5 P/SF	6 P	7 G	8 G	9 G
10 P/SF	11 G	12 G	13 G	14 G	15 G	16 G
17 F	18 F	19 F	20 F	21 F	22 G	23 G
24 G	25 G	26 G	27 G	28 G	29 G	30 G

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READER SERVICE

A46	ABC Communications	40
A1	Adirondack Radio Supply	106
A24	Adva Electronics	186
A94	Advanced Electronic Applications	151
*	Advance Electronics	145
A60	AED Electronics	10
A92	AHF Antennas	153
A2	Aldelco	184
A95	Amateur Electronics Supply/Atlas	37
A98	Amateur Radio Center/Atlas	49
A55	Amateur Radio Supply	106
A40	Amat. Radio Supply of Nashville, Inc.	117
A58	American Crystal Supply	152
A26	Amidon Associates	133
*	Amsat	64
A62	Antenna Specialists	95
A81	AP Industries	15
A6	Aptron Laboratories	10
*	Associated Radio	180
A16	Atlas Radio Inc.	31
A93	Avanti R & D	48
B23	Barker-Williamson	150
B49	J.S. Betts Company	136
B45	B & K Precision	25
B42	Brodie Electronics Company	150
B6	Bullet Electronics	176, 177
B30	Burghardt Amateur Center/Atlas	45
C88	C & A Electronics Enterprises	75
C3	Clegg	77, 115
C21	Coakit	15
C106	Command Productions	143
C58	Communications Center, NE	81, 111
C5	Communications Elec.	143
C115	Communications Elec. Specialties	153
C89	Communications Services	166
C6	Communications Specialists	16, 17
C105	Communications & TV Unltd	150
C119	Cook Communications Corp	110
C67	Cushcraft	24
C140	CW Electronics Sales Co/Atlas	53
D6	Peter W. Dahl Company	35
D35	Daytapro Electronics, Inc.	10
D49	Deltroniks	152
D20	Digital Research Corporation	174, 175
D23	Dovetron	107
D25	DSI Instruments	137, 139, 141
*	Eagle Electronics	106
*	Ehrhorn Technological Operations, Inc.	149
E43	Electronics International Service Corp/Atlas	59
F5	Flesher Corporation	95, 104, 105
G12	Germantown Amateur Supply	44
G26	G & G Radio Electronics Co.	136
G22	G.I.S.M.O.	104
G4	Godbout Electronics	178
H40	HAL Communications Corporation	21
H24	Hal-Tronix	82
H2	Ham Radio Center	10, 15, 73, 90, 95, 136, 143
H16	Hamtronics, NY	173
H8	Hamtronics, PA	10
H26	Hartwell's Office World	143
H5	Heath	11
H3	Henry Radio	CII, 63
H4	Hy-Gain	25
I1	ICOM	23, 119
I32	Instant Software	84, 85, 93
I9	Integrated Circuits, Unltd.	185
J1	Jameco Electronics	101, 179
J2	Jan Crystals	150
*	Kenwood	CIV, 5, 134, 135
K14	Key Electronics	95
*	Kilobaud	83
K4	KLM Electronics	136
*	Little Rock Ham O Rama	136
L9	Long's Electronics	120-125
M48	Macrotronics, Inc.	143
M35	Madison Electronics Supply	70, 71
M36	Maggiore Electronic Lab	167
M96	Meinken Distribution	104
M52	MFJ Enterprises	27, 62, 103
M69	Micro Control Specialties	152
M95	Micro Management Systems	143
M92	J.W. Miller Div. Bell Industries	24, 165
M57	Monroe Electronics	118
O5	OK Machine & Tool	89
O3	Optoelectronics, Inc.	24, 164
O12	Outdoor Outfitters	133
*	Palomar Engineers	98
P41	P.C. Electronics	107
P44	Pickering Codemaster Company	67
*	Plainsman Micro Systems	91
P2	Poly Paks	181
P47	Professional Aids Co.	105
Q3	Quest Electronics	169
R1	Radio Amateur Callbook, Inc	183
*	Radio Bookshop	15
*	Radio World	95
R6	Ramsey Electronics	172
R27	RF Power Labs, Inc.	152
S27	Sabtronics	170
S63	Semiconductors Surplus	171
S33	S-F Amateur Radio Services	15, 153
S81	Spectronics, Inc.	52, 168
S8	Spectrum Communications	78, 79
S10	SST Electronics	153
S50	O.C. Stafford Electronics	10
S18	Standard Communications	90
S43	Surplus Electronics	182
S44	Swan Electronics	8, 9
T52	Tele-Tow'r Mfg. Co., Inc.	151
*	Ten-Tec	7, 97
T55	TET U.S.A.	113
T34	Thomas Communications	109
T34	Thomas Communications/Atlas	41
T48	Tower Electronics Corp	26, 105, 107, 118
*	R. Lee Tower International	152
T18	Trac Electronics, Inc.	98
T3	Tufts Radio Electronics	80, 90
U10	UDM Enterprises	95
U2	Unarco-Rohn	106
U9	Unadilla/Reyco Division	25, 133
U8	United Products	187
U5	Universal Amateur Radio Service, Inc.	118
V23	Valor Enterprises	15
W15	Wacom	118
W18	Western Electronics	107
W2	Wilson Electronics	3
X3	Xitex Corp.	52
Y1	Yaesu Electronics Corporation	CIII, 65, 99
From 73		Pages 131, 189-194

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